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The National Agriculture Magazine



AGRICULTURE

YEAR BOOK 2009

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From Chief Editor's Desk

Dear Readers,

I am extremely happy to present the second edition of Agriculture Today Yearbook 2009. The huge response received for the Year Book 2008 from all sections of the readers was quite overwhelming for us, and which inspired us to work on the 2nd edition. I am grateful to all the readers for their continued support and encouragement to Agriculture Today. With their patronage, the magazine has today emerged as the voice of stake-holders in agriculture. The magazine is not only creating awareness and opinions and providing effective link to the stake holders in the agriculture system at the national level, but also influencing policies, related to agriculture and agribusiness.

Like the first edition in 2008, the Year Book 2009 also contains a pool of informative articles, contributed by most eminent persons in Indian agriculture. Articles on various topics are presented in a lucid way for better reading. Data and analysis is juxtaposed through out the Book, balancing the presentations of the contents.

I whole heartedly thank all the eminent persons for their contributing informative and time relevant articles for the Year Book. These are the pearls that we have beaded together to shape this Year Book. I hope that the Year Book will serve as a useful guide and reference material to all those related to the agriculture sector, including Government officials, policy makers, scientists, agribusiness companies, NGOs, institutions, agri researchers, professionals, planners etc.. Despite our best efforts, I realize that there is still scope for further improvement and we shall better our efforts in the next edition in 2010.

I request all the esteemed readers to lend their valuable support by way of sending comments and suggestions. I promise to continuously improve and come out next edition, further better in quality and contents in our strive to reach new heights and continuously live up to the expectations of our readers.

At the end, I would like to thank our beloved Dr. KL Chadha, Pioneer of Horticulture Revolution in India, for taking the responsibility of being the Chairman of the Editorial Board and enrich this venture with his contributions. I may also like to thank the entire Agriculture Today team, especially, Ms. Anjana Nair, Ayan Banerjee, Abid Hussain, Jatin Joshi, Tafeem Siddiqui and Abdul Rehman for their untiring efforts in completion of this year book.

With best wishes

M.J. Khan

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The visionary and his vision...

Agriculture Integrated to Sustain

The Green Revolution of the sixties helped us to instill self-confidence in our agricultural capability and also to purchase time in relation to achieving a balance between population growth and food production. Such a revolutionary progress particularly in the production of wheat and rice became possible through synergy between technology and public policy supported by farmers' enthusiasm generated through National Demonstrations in the fields of resource poor farmers with small holdings. From the nineties onwards there has been a deceleration in the rate of growth of food production. It is widely felt that there has been a fatigue of the green revolution. Simultaneously, several environmental and economic problems hampering agricultural growth appeared. Obviously, if farm economics and ecology go wrong, nothing else will go right in agriculture.

In January 1968, addressing the Indian Science Congress at Varanasi, I made the following statement:

"Exploitive agriculture offers great dangers if carried out with only an immediate profit or production motive. The emerging exploitive farming community in India should become aware of this. Intensive cultivation of land without conservation of soil fertility and soil structure would lead, ultimately, to the springing up of deserts. Irrigation without arrangements for drainage would result in soils getting alkaline or saline. Indiscriminate use of pesticides, fungicides and herbicides could cause adverse changes in biological balance as well as lead to an increase in the incidence of cancer and other diseases, through the toxic residues present in the grains or other edible parts. Unscientific tapping of underground water will lead to the rapid exhaustion of this wonderful capital resource left to us through ages of natural farming. The rapid replacement of numerous locally adapted varieties with one or two high-yielding strains in large contiguous areas would result in the spread of serious diseases capable of wiping out the entire crop, as happened prior to the Irish potato famine of 1854 and the Bengal rice famine in 1942. Therefore the initiation of exploitive agriculture without a proper understanding of the various consequences of every one of the changes introduced into traditional agriculture, and without first building up a proper scientific and training base to sustain it, may only lead us, in the long run, into an era of agricultural disaster rather than one of agricultural prosperity."

Dr. M S Swaminathan

Later, I coined the term the Ever-green Revolution to denote the need for enhancing productivity in perpetuity without associated ecological harm. The pathways to achieving an Ever-green Revolution could be either organic farming or green agriculture. Organic farming precludes the use of mineral fertilizers, chemical pesticides and genetically modified varieties. It however permits the use of marker assisted selection. In contrast, Green Agriculture promotes the use of integrated nutrient supply, integrated pests management and appropriate varieties, whether developed by Mendelian or Molecular breeding.

Organic farming will be possible if crop – livestock farming systems can be adopted. In our country, nearly 80% of farmers possess only one hectare of land or below. For such resource poor farmers green agriculture will be the feasible method of soil fertility restoration and effective plant protection. Therefore we should develop certification procedures both for green agriculture and organic farming.

Ever-green Revolution will help us

to take advantage of the vast untapped yield reservoir existing in most cropping systems even with the technologies on the shelf. Rising international food costs and diminishing global and national food reserves emphasise that we should depend for our food security mainly on home grown food. A home grown food based food security system has also the advantage that it can help to increase the income of farmers and strengthen rural livelihoods.

Inspite of our progress in agriculture, we still have a large number of children, women and men going to bed partially hungry. We should therefore impart a nutrition dimension to food production. I would like to briefly discuss methods of achieving nutrition security for all.

The Government of India has promoted a paradigm shift in policy and programme formulation from food security at the aggregate level to nutrition security at the individual level. Nutrition security is best defined as "physical, economic and social access to balanced diet, safe drinking water, environmental hygiene, primary healthcare and primary education". Thus attention to both food and non-food factors will be important for achieving nutrition security at the level of each child, woman and man.

Both childhood and adult Malnutrition levels are unacceptably high in most parts of the country. There is need to focus attention on the states where the frequency of malnutrition is very high such as Orissa, Jharkhand, Bihar, etc. The data should also be disaggregated according to gender and age. The nutritional problems relating to women and children should be highlighted. The statistics should not be only one of despair but also should be one of hope, drawing attention to the best examples of overcoming both endemic and hidden (i.e. deficiency of micronutrients like iron, iodine, zinc and Vitamin A) hunger.

The response of state and central governments, industry, academic civil society organizations, bilateral and multilateral agencies, financial institutions and the mass media should be on a life cycle basis. The presently available nutrition support schemes available may be grouped as follows:

- Pregnant women with reference to maternal and fetal under-nutrition leading to babies with low birth weight
- 0-2 infants (age group needing special attention and care)
- 2-6 children - ICDS
- 6-16 school going children - Noon-meal programmes
- Adults – Food for Work, NREGA, PDS etc.,
- Old and infirm persons – special programmes like Annapoorna

A life cycle approach will help to identify gaps and deficiencies in ongoing programmes and help to ensure nutrition security from birth to death. The Action Plan for Nutritional Malady – Horticultural Remedy promoting a Nutrition Secure India should be doable and affordable. For example, a universal PDS expanded to cover locally grown nutritious millets, tubers etc., as well as dhal, and edible oil could be implemented with the potential for an immediate impact on malnutrition. The various ongoing missions like the National Horticulture Mission, National Food Security Mission and Rashtriya Krishi Vikas Yojana can make a substantial contribution to achieving nutrition security for all, provided nutritional dimensions can be mainstreamed into the planning and resource allocation process relating to these well funded National Missions. For this purpose a Nutrition Task Force consisting of eminent experts may be attached to each of the Missions. The Nutrition Task Force attached to the Horticulture Mission can indicate how local level nutritional maladies, with particular reference to micronutrient deficiencies, can be overcome through horticultural remedies.

Hunger Fighters:

Finally, Panchayati Raj Institutions are powerful tools for spreading Nutrition Literacy and for ensuring the success of nutrition intervention and safety net programmes. It will be useful to undertake the training of one woman and one male member in each Panchayat as Hunger Fighters. The Grameen Gyan Abhiyan Movement involving the establishment of a Gyan Chaupal in every Panchayat could be mobilized for Nutrition Literacy and Advocacy. Panchayati Raj Institutions can also help in achieving convergence and synergy among numerous on-going programmes based on a life cycle approach. The Gram Sabhas could monitor the impact of nutrition support programmes based on indicators like the frequency of LBW children, IMR, MMR, stunting, wasting, etc., Continuous monitoring by Gram Sabhas assisted by expert guidance from agricultural, rural, and women's colleges and home science colleges will help to ensure that the programmes are really effective at the ground level.

Nutrition secure India is an idea whose time has come, because of our high economic growth rate and vast untapped agricultural production potential. However, this can be achieved only if there is the requisite fusion of political will and action, professional skill and peoples' participation.

Noted Agriculture Scientist and MP (Rajya Sabha)

Dutta Irriga-tion

Agriculture – The Current Overview

Indian Agriculture
A study with numbers

GDP and Agriculture

The contribution of agriculture towards India's GDP has been declining over the years. As a nation travels on the path to becoming a developed economy, the level of contribution of Agriculture is seen to come down in the nation's total GDP. However, India cannot take this as a sole indicator, as the services sector has increased considerably but the manufacturing sector has not increased to that extent. For a nation to grow, decrease in contribution of agriculture must be accompanied alongside with substantial increase in the manufacturing sector.

Growth rate (CAGR)in Paddy (2004-05 to 2007-08)

State	Acreage	Production
AP	-0.12	11.4
Bihar	-5.5	22
Gujarat	0.6	6.38
Haryana	-0.4	6.12
MP	-15.39	3.2
Maharashtra	0.08	11
Punjab	0.09	0.16
Rajasthan	-8.4	20
UP	-0.37	7.1
Tamil Nadu	-1.6	26.6
West Bengal	-1.11	-0.48
Orissa	-0.4	5
All India	**-0.43**	**5**

GDP and Indian Agriculture

	GDP from Agriculture	As % of Total GDP
2006-07	588530	20
2005-06	566163	21
2004-05	535037	22
2003-04	531302	23

Source: Economic Survey, 2008

Acreage of Major Crops

Detailed Crop Acreage of the Country

- Area and production of all the important crops have increased during the period between 2002-03 and 2006-07
- Area of fruits has increased significantly (by more than 45%) during the period. However, its to be noted that 2006-07 was advance estimates

Increased acreage of horticultural crops is clear driver of the farm implements like plant protection equipment market in recent times and in the near future to come.

Crop Acreages

Agrochemical market growth is dependent on the principle of disease triangle i.e. Host – Pathogen – Environment. Therefore crop acreage and its trend govern the usage of different types of agrochemicals.

Paddy

Acreage under paddy is decreasing at a marginal rate of 0.43 per cent; however production is increasing at the rate of 5 per cent. The major states where acreage is decreasing are AP, Bihar, and Tamil Nadu, however production is increasing at the rate of 11, 22 & 26 percent respectively. It reflects that more area is coming under HYV and hybrids and use of inputs as fertilizers & agrochemicals is also

Crop Acreage of the country in different years

Crops	Area/Production	2002-03	2003-04	2004-05	2005-06	2006-07 (Advance estimates)
Cereals	Area (m ha)	93363.8	99988.4	97315	99208.3	100516.3
	Prod (m tons)	163646.4	198284.2	185233.3	195217.2	203084.6
Fruits	Area ('000 ha)	3787.9	4746.3	4963.8	5323.5	5506
	Prod ('000 tons)	NA	157834.9	169839.7	182391.6	185878.8
Pulses	Area ('000 ha)	20496.2	23458.1	22763	22391.3	23191.7
	Prod ('000 tons)	11125	14905.2	13129.5	13384.4	14197.5
Sugarcane	Area ('000 ha)	4520.3	3938.4	3661.5	4201.7	5150.8
	Prod ('000 tons)	287383.2	233861.8	237088.4	281171.8	355519.7
Wheat	Area ('000 ha)	25195.7	26594.7	26382.9	26483.6	27994.5
	Prod ('000 tons)	65760.8	72156.2	68636.9	69354.5	75806.7
Paddy	Area ('000 ha)	41176.1	42592.5	41906.7	43659.8	43813.6
	Prod ('000 tons)	NA	83131.7	91793.4	93355.3	96431

Source: Min. of Agri, Govt. of India

CAGR of Cotton Crop Acreage and Production (2001-02 to 2006-07)		
State	Acreage	Production
Punjab	21.5	22
Haryana	8.6	25
Rajasthan	1.4	27
Gujarat	21.7	23
Maharashtra	17.9	8
AP	13.4	3
Karnataka	18.9	-3
India	**27.5**	**11**

Growth rate (CAGR)in Sugarcane (2000-01 to 2006-07)		
State	Acreage	Production
AP	1.8	3.45
Bihar	3.4	6.9
Chattisgarh	18.7	13.8
Gujarat	2.25	3.5
Haryana	-0.3	2.6
Karnataka	-4.7	-6.5
Maharashtra	9	7.9
Punjab	-1.2	-4
Tamil Nadu	1.5	3.6
UP	1.6	3.9
Uttaranchal	0.11	-3
West Bengal	1.8	-2.4
All India	**2.2**	**3**

increasing. Figure indicates that the major market growth in paddy segment will be in AP, Bihar, Tamil Nadu, while in other states market will grow at nominal rate

Cotton

Acreage in cotton is growing at an annual growth rate of 27.5 per cent, however production is growing at a lower rate of 11 per cent annually. Major shift is due to the introduction of Bt cotton during the last few years, however this growth rate will come down in future 2 to 3 years and on the other hand production will go up. In the coming years, major agrochemical market for sucking pest will grow in Punjab, Haryana, Gujarat, Maharashtra, AP & Karnataka, however total insecticides market in cotton will further come down.

Sugarcane

Acreage under sugarcane is more or less stable and is growing at a marginal rate of 2 per cent and production is also increasing at a nominal growth of 3 %. States showing decreasing trends are Haryana, Karnataka, Punjab, Uttaranchal & West Bengal on the other hand acreage is growing in Chattisgarh & Maharashtra

Vegetables

Acreage under vegetable crop is growing at an annual growth rate of 2.5 per cent since last 5 years; however yield is more or less stable. Vegetables are high agrochemical consuming crops therefore states where area under vegetables are increasing, agrochemical sales are bound to go up. In some states even if acreage has been improving, productivity has been showing the opposite trend especially in Karnataka, Maharashtra, Haryana, Punjab & J&K. Therefore there is huge scope for using quality inputs including agrochemicals.

Fruit Crop

Acreage under fruit crops is increasing at the annual growth rate of 6.5 per cent, while production is increasing at an annual growth rate of 5.6 per cent which means overall productivity is not increasing, however more area is coming under fruit crops and in turn agrochemicals consumption per unit area will increase and as productivity is still maintained at an earlier level, there

Growth rate (CAGR) in Vegetables (2000-01 to 2004-05)		
State	Acreage	Yield (MT/ha)
West Bengal	3.5	-2.0
Uttar Pradesh	6.0	-0.9
Bihar	2.0	3.1
Orissa	-1.3	1.7
Tamil Nadu	1.2	1.2
Gujarat	13.1	-0.3
Karnataka	2.1	-8.3
Maharashtra	-0.5	-3.6
Andhra Pradesh	0.7	4.3
Jharkhand	8.4	1.9
Haryana	8.0	-2.0
Punjab	3.0	-1.0
Madhya Pradesh	-2.5	-0.5
Himachal Pradesh	7.6	1.2
Uttaranchal	-7.0	4.7
Jammu & Kashmir	2.7	-0.6
Rajasthan	5.3	6.1
India	**2.4**	**0.0**

Growth rate (CAGR) in Fruit crop (2001-02 to 2006-07)		
State	**Acreage**	**Production**
AP	7.2	4.8
Bihar	0.44	-1.2
Gujarat	13.3	12.3
HP	-2.4	8.3
J&K	3.8	12.5
Karnataka	1.05	1.2
MP	0.4	10.3
Maharashtra	19	3.4
Punjab	8.8	3.3
Rajasthan	4.3	-0.14
Uttaranchal	-3.2	11.9
UP	-0.44	6.19
West Bengal	8.3	6.3
All India	**6.5**	**5.6**

Growth rate (CAGR) in Pulses crop (2001-02 to 2006-07)		
State	**Acreage**	**Production**
AP	0.65	3.44
Bihar	-2.6	-4.3
Gujarat	6.4	9.3
Haryana	-1.8	-1.1
Karnataka	4.5	3.5
MP	-0.29	-0.1
Punjab	-9.8	-5.5
Rajasthan	-0.9	0.76
Tamil Nadu	-6	-1.5
UP	0.3	-3.6
West Bengal	-2.4	-2.5
All India	**1.05**	**1.2**

Growth rate (CAGR)in Wheat crop (2001-02 to 2007-08)		
State	**Acreage**	**Production**
Bihar	0.14	0.08
Chattisgarh	-0.8	-0.7
Gujarat	19.8	21.9
Haryana	1.2	1.4
Jharkhand	4.6	2
MP	0.17	0.7
Maharashtra	8.3	11.6
Punjab	0.35	0.26
Rajasthan	2.1	1.8
UP	-0.2	-0.04
Uttaranchal	0.7	-0.6
All India	**1.11**	**1.25**

is huge scope of increasing the same.

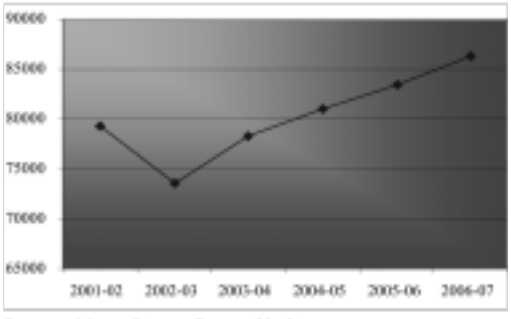
Pulses & Wheat

Acreage and production is more or less stable for Pulses & Wheat and there is no significant increase in acreage or production that means productivity is maintained at the earlier level and there is scope for increasing productivity per unit land by proper crop management and use of quality agro-inputs

Irrigation Scenario

- Barring 2002-03, there has been a constant increase in the total area under irrigation in the country (Figure 3).
- There is a net increase of 8.6% in the total irrigated area between 2001-02 (79.3 million ha) and 2006-07 (86.2 million ha)
- Irrigated area in Madhya Pradesh has increased significantly, indicating clearly that it's a strategic state for farm implements, most importantly PPEs.
- Area under irrigation in Rajasthan and Karnataka has also increased significantly by 18% and 16.6% respectively.
- Chattisgarh would be another strategic state for players in farm equipments as this state has increased its area under irrigation between 2001-02 and 2006-07 by 21 % and is also a state where cultivation of fruits has increased the maximum. The area under fruit cultivation in Chattisgarh increased steeply from 16000 ha in 2002-

ig 3: Total Area under Irrigation in India ('000 ha)



Source: Min. of Agri, Govt. of India

Area under irrigation in diff states ('000 ha)							
States	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	% growth (between 2001-02 and 2006-07)
AP	5916	4536	4781	4987	5996	6070	2.6
Assam	209	209	209	199	197	190	-9
Bihar	4539	4572	4567	4197	4325	4427	-2.4
Chattisgarh	1227	1144	1179	1312	1375	1486	21
Har	5311	5199	5343	5434	5446	5461	2.8
Karntk	3089	2841	2702	3328	3632	3603	16.6
M.P.	4899	4631	5776	6193	5878	6543	33.5
Mah	4271	4249	4271	4175	4242	4445	4
Orissa	2546	1712	2518	2691	2687	2681	5
Pun	7667	7543	7722	7702	7723	7759	1
Raj	6744	5272	6393	7093	7818	7958	18
UP	18220	17792	18524	18939	18689	19120	5
WB	5426	5282	5387	5339	5353	5429	Negligible increase
India Total	**79320**	**73503**	78270	81052	83375	86218	8.6

Source: Min of Agriculture, Govt. of India

Loans given to farm sector in different years				
Years	Co-operative banks	Regional rural banks	Commercial banks	Total
1997-98	14085	2040	15831	31956
1998-99	15957	2460	18443	36860
1999-00	18429	3329	22854	44612
2000-01	21909	3807	27788	53504
2001-02	27080	4956	34735	66771
2002-03	23716.4	6069.79	39773.6	6959
2003-04	26958.79	7581.15	52440.85	86981
2004-05	31424.23	12404	81481.41	125309
2005-06	39403.77	15222.9	125858.9	180486
2006-07	42480	20435	140382	203297
2007-08 (Till Oct-07)	33070.17	15924.56	88764.83	137760

Source: Reserve Bank of India

Scenario of Public and Private Investment in Agriculture							
					Share in Total		
Year	Public Investment	Private Investment	Total	GDP at Market Price	Public	Private	Total
2002-03	8733	46935	55668	2216260	0.4	2.1	2.5
2003-04	10805	43035	53840	2402248	0.4	1.8	2.2
2004-05	11038	46215	57253	2602235	0.4	1.8	2.2
2005-06	14144	49987	64131	2842478	0.5	1.8	2.3

Source: NABARD

Gross Capital Formation in Agriculture Sector at 1999-2000 prices					
	GCF Total	GCF Agri	Share of Agri in Total GFC (%)	GDP Agriculture	GCF/GDP in agriculture (%)
1999-2000	506244	43473	8.6	409660	10.6
2000-01	488658	39027	8	407176	9.6
2001-02	474448	48215	10.2	433475	11.1
2002-03	555287	46823	8.4	398206	11.8
2003-04	665625	44833	6.7	441360	10.2
2004-05	795642	49108	6.2	441183	11.1
2005-06	950102	54905	5.8	468013	11.7
2006-07	1053323	60762	5.8	485937	12.5

03 to 90000 ha in 2006-07.

Agriculture Credit

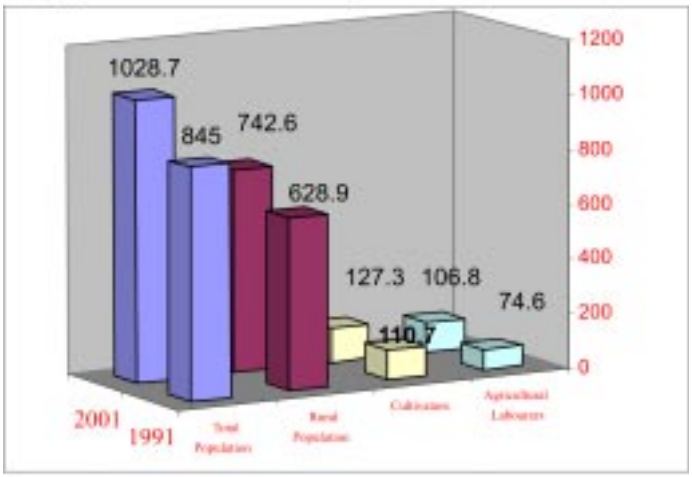
Credit flow in agriculture has also increased significantly in the last 4 years, clearly indicating thrust on the use of quality inputs in agriculture along with government priority. With realization of better prices for agriculture produce, loan repayment is also better in comparison with the earlier years. This trend indicates that farmers are trying to increase productivity for maximizing returns, and they are also ready to invest in quality farm inputs including agricultural implements which increases input efficiency and reduces costs. Further thrust of government on horticulture (through various schemes of NHB / Horticulture Mission) as a growth driver for agriculture will further see growth of agro implements for horticulture use.

Capital Formation in Agriculture

Gross capital formation in agriculture is decreasing in relation to the total capital formation over the years, which indicates reduced government role in development (agro infrastructure) of agriculture, however GDP in agriculture is increasing on marginal basis and production as a whole is more or less stable which inturn indicates better realization of farm produce (considering inflation as well). Although government role is decreasing, government with its policies is promoting private sector participation in agriculture through

Budgetary Allocation in Agri-sector		
	Allocation	% of total
2009-10	10136	2.4
2008-09	10074	2.6
2007-08	8558	2.7
2006-07	7391	3
2005-06	5907	2.9
2004-05	4643	2.8
2003-04	3671	2.6
Source: Ministry of Finance, Govt. of India		

Employment Generation in Agriculture (in millions)



Source: 1991 and 2001 census, Govt. of India

Public Private Partnership.

Public vs. Private investment in agriculture

Private investment in agriculture is increasing along with the increase in public investment. However, public sector investment has grown at a CARGR of 17% during 2002-03 and 2005-06, private investment has only grown by CAGR of 2% between the same periods. This indicates that agriculture sector is still dependent on government for investments.

Budgetary allocation in agriculture (in Rs crores)

Budgetary allocation for agriculture is increasing over the years however percent of total allocation is more or less stable and large benefit mainly goes back to the government in the form of subsidies, clearly indicating less money left for agro infrastructure development.

Agriculture and Employment Generation

- Rural population of the country increased from 628.9 million in 1991 to 742.6 million in 2001. This is a net increase of 18% (Figure 4)
- However, number of actual cultivators increased in a lesser rate by just about 15% during the same period.
- Another notable point of concern is the drastic increase of 43% in the total population of agricultural laborers. as per records, however this increase does not suggest total availability of farm labour as most of them are engaged in other activities (SSI units) rather then agriculture.

The number of actual cultivators is not increasing in tandem with the total rural population and increase in the total number of agricultural laborers—these two are major challenges to be tackled towards the overall growth of the farming sector in general and growth of the market size of farm implements in the country.

Editorial Team, Agriculture Today

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"In Focus"

Towards a thriving Indian Agriculture: Challenges and Prospects

Dr RB Singh

Main Challenges

Touching the daily life of about 600 million people comprising nearly 120 million farming families, agriculture continues to be the life thread of the nation. It accounts for about 18% of the national GDP, over 50% of the employment and over 70% of the Indian rural work force. Thus, if agriculture fails, everything else will fail.

The term "farmer" as per the National Commission on Farmers (NCF) refers to both men and women, and includes landless agricultural labourers, sharecroppers, tenants, small marginal and submarginal cultivators, farmers with larger holdings, fishers, livestock and poultry rearers, pastoralists, small plantation farmers, as well as rural and tribal families engaged in a wide variety of farming related occupations such as apiculture, sericulture and vermiculture.

During the Green Revolution era, agricultural production and productivity had more than doubled and the intensity of hunger and poverty halved. Since the mid-1990s, while the overall GDP growth rate of 7-9% was recorded, the agricultural growth hovered around 1.5-2% per annum. This resulted in the doubling of the income gap between farmers and non-farmers from 1:3-1:6.

The decelerated agricultural growth had caused further marginalization of rural population, widened urban-rural and inter-state divides and created hot spots of acute distress, indebtedness, deprivation and even farmers suicides.

The agrarian crisis is attributed to several factors. Continuous decline in investment in agriculture, neglect of the interest of farmers, deterioration in terms of trade for agriculture, predominance of marginal and sub-marginal farmers, debt crisis, and stagnating farmer's income, which meets hardly 80% of their needs and requirements, are some of the major underlying factors. Moreover, ineffective and negligible output price interventions in agriculturally underdeveloped regions have failed to stimulate increased productivity and production.

Public investment did not increase to keep pace with the needs of output growth. During the past Plans, highest agricultural investment was in irrigation, but there was hardly any increase in net irrigated area, and cropping intensity continues to be low.

Adoption of modern technology was slow and public sector extension has become obsolete. The technology missions have also generally not delivered. Deceleration in total factor productivity (TFP) growth rate, increasing thirst, hunger (especially hidden hunger) and failing health of our soils, and fast depleting and degrading water resources (often policy-induced) are major concerns. Further, size of farm holdings is fast decreasing; over 60% of our operational holdings are less than one ha and generally uneconomical.

Although the amount of credit has tripled over the last 3 years, the number of borrowers has declined and bulk of the credit has been cornered by large farmers. The majority i.e., marginal and submarginal resource-poor farmers and other rural poor met over 80% of their credit needs from non-formal sources. Layers of debts and unusual stresses had thus intensified specially in rainfed areas. Moreover, agricultural insurance and other insurance coverages of farmers have been extremely poor, whereas the vulnerability and risks both in monsoon and the market have accentuated.

Rural markets and other infrastructure and farmer-market linkage are extremely poor. About 80% of

the marketing costs are avoidable. Further, about 30% of produce is wasted and value addition in agricultural commodities is less than 10%. Moreover, neglect of quality, bio-safety, IPR, SPS, TRIPS and other regulatory arrangements and unlevelled playing fields in the post WTO regime are big hurdles.

To sum up, despite the Green Revolution and good agricultural progress made during the past four decades, agrarian crisis continues. Technology fatigue, glaring technology transfer gaps, extension failures, huge post harvest losses (estimated US$ 15 billion annually), declining net agricultural trade intensity and food self-sufficiency, worsening cost-risk-return structure of farming and rising farmers' indebtedness dot the agrarian landscape.

Converting Intention into Actions and Outcomes

The Union Budget 2009-10 seeks to achieve accelerated and inclusive growth and equitable development. It aims attaining agricultural growth rate of 4% annum, enhancing employment security (creating 12 million new work opportunities per year), halving the poverty percentage by 2014, enhancing the range and reach of social safety nets and establishing and strengthening social schemes, such as National Food Security Act, Bharat Nirman, National Rural Health Mission and National Rural Livelihood Mission.

More directly for Agriculture and Rural Development, agriculture credit flow for the year 2009-10 is targeted at Rs.3,25,000 crore at the interest rate of 7%, with a subvention of 1% for this year for those repaying their short term loans on schedule. The proposed credit flow is quite substantial, but its distribution should not be lopsided and the truly needy farmers should not be left out. Further, as recommended by the NCF, the interest rate should be reduced to 4% and even to 0% in the event of national disasters such as droughts and floods.

The one-time bank loan waiver of about Rs.71,000 crore in 2008 had mostly helped the loan-providing banks in recovering their "bad debts". The other major beneficiaries were large farmers who had cornered bulk of the credit funds. In principle, loan waiving under extreme conditions is welcomed, but it must benefit the truly distressed and helpless ones. An Agriculture Risk Fund, as suggested by the NCF, should be instituted to insulate farmers from recurrent droughts and floods, and also to avoid *ad hocism* in distribution of relief funds. Simple and reliable (such as based on weather) procedures should be adopted for farm family and farming insurance (including health).

The increased allocations under Accelerated Irrigation Benefit Programme and nutrient based fertilizer pricing and subsidy regimes to enhance balanced usage of fertilizers are steps in the right direction. The budget allocations should be made or partly diverted also for enriching the knowledge base and software components to enhance use-efficiency of these inputs. Clear cut and simple guidelines must be formulated and made widely known for implementing the nutrient-based fertilizer pricing and subsidy policy.

Research, technology transfer and extension supports are essential for increasing science-led judicious and efficient use of the vital inputs as well as for mainstreaming marginal and sub-marginal farmers in agrarian development. It is rather surprising that agricultural research and technology transfer have not been provided with even a token increase in the 2009-2010 budgetary allocation, despite the fact that internal rate of return on investment in agricultural research is one of the highest.

NREGA is a landmark development for increasing inclusiveness through the congruence of Right to

Employment, Right to Food and Right to Information. The usefulness of the Scheme could be broadened by promoting skill enhancement and skill-based employment. Further, congruence among analogous schemes should be effected to minimise wasteful duplications and to maximize synergistic outcomes.

India has the largest bulge of youth and unemployed youth. Measures should be introduced which could help attract and retain youths in farming by making it intellectually stimulating and economically rewarding and by conferring the power and economy of scale to small and marginal farmers both in production and post-harvest phases of farming. Each agricultural graduate should be an entrepreneur and associated public-private sector support such as creation of agriclinics, e-chaupals and revamping of the Small Farmers Agribusiness Consortium should be assured.

Policy Thrusts

- Overcome unacceptably high levels of hunger and poverty through sustaining and accelerating growth in agricultural productivity, raising to at least 2.5% annual growth rate in foodgrains, especially pulses and oilseeds, and 6% each in livestock, horticulture and fisheries – the 'sunrise' sub-sectors, and these will add up to the cherished overall agricultural growth rate of about 4%;
- Reduce the productivity gap between marginal and favoured areas; increase average yields by 50% in rainfed areas and about 35% in irrigated areas during the next 10 years;
- Bridge huge yield gaps of 50-200% by overcoming the technology fatigue, collapse of extension services and timely supply of adequate quantity of quality inputs,
- Prevent the colossal post-harvest losses by developing cold chains and warehouse facilities, efficient retail systems to link farmers directly with markets and strengthening value addition along the farm to fork chain.
- Develop and introduce integrated Flood Code, Drought Code and Good Weather Code for mitigating and managing aberrant weather and climate changes.

Inclusiveness and mainstreaming of the human and gender dimensions should be assured in all farm policies and programmes and given explicit attention to sustainable rural livelihoods. Productivity, profitability and income of the overwhelmingly large proportion of small, marginal, submarginal and landless farmers should be enhanced through developing, transferring and providing appropriate technologies, inputs and services and improving input use efficiency.

Science and technology must always be recognised as the drivers of modern agriculture. Public-private investment in agricultural research and technology development should be drastically enhanced. Strategic research for developing cutting edge technologies, like biotechnologies, and their biosecure use is the need of the day. Agricultural curricula should be restructured for enabling every farm and home science graduate to become an entrepreneur and to make agricultural education gender sensitive.

The unfinished agenda in land reforms should be completed and promotion of renewable energy should be initiated. Diversion of productive agricultural lands to non-agricultural uses should be stopped. Water should be declared a common property. Concealed tenancy should be eliminated and land-leasing acts and contract-farming provisions should be rendered transparent and farmer friendly. Waste/degraded lands should be reclaimed and distributed to landless farmers and allocated for non-agricultural uses. Support of industries and private sector should be sought in developing such lands and ensuring mutual reinforcement of agriculture, energy and industry in the national interest.

A National Land and Water Use Advisory Service should be established and linked to State and Block Level Land and Water Use Advisory Services on a hub and spokes model. These can be virtual organisations with the capacity to link land and water use decisions with ecological, meteorological and marketing factors on a location and season specific basis. They should provide proactive advice to farmers on land and water use.

Protection and improvement of land, water, bio-diversity and climate resources is essential for sustained advances in the productiv-

ity, profitability and stability of major farming systems. A Seeds and Breeds National Mission should be initiated under which could be established national livestock heritage banks, genome clubs and genetic literacy, biovalleys and gene sanctuaries. Traditional knowledge should be linked with modern knowledge and traditional wisdom should be conserved and the conserving communities, particularly tribal populations, should be duly rewarded. Indigenous medicinal and aromatic plants, botanicals, and biofuel species should be judiciously harnessed and special policies for management of Exclusive Economic Zones (EEZs) and integrated development of coastal zones, hills and mountains and the major river basins should be developed and implemented.

Repeated outbreaks of Swine Fever and Avian Flu and the danger of new races of wheat rust, such as UG99, are serious threats to food and health security. Strengthening the bio-security of crops, farm animals, fish and forest trees for safeguarding both the work and income security of farmer families and the health and trade security of the nation can hardly be overemphasized. IPR, SPS and other biosecurity and regulatory measures must be augmented. A comprehensive National Agricultural Biosecurity System ought to be established.

Every cloud has a silver lining. Even the currently experienced high food prices offer an opportunity. In the long run, high food prices represent an opportunity for agriculture (including small holder farmers) throughout the developing world, but it will have to be accompanied by the provision of essential public goods. Smallholder gains could fuel broader economic and rural development. Farming households can seek immediate gains; other rural households may benefit in the longer run if higher prices turn into opportunities for increasing output and creating employment.

In order to benefit both the farmers and the consumers, price protection mechanisms as well as public distribution systems (PDS) would need to be strengthened. A Market Price Stabilization Fund should be established jointly by Central and State Governments and financial institutions to protect farmers during periods of violent fluctuations in prices.

The scope of the MSP programme should be expanded to cover all crops of importance to food and income security for small farmers. Also, advice to farmers on crop diversification should be linked to the assurance of MSP. Small farm families should not be exposed to administrative and academic experiments and gambles in the market. Further, in order to buttress farmers as well as consumers from the negative impacts of WTO Agreements as well as from the outdated domestic market acts and provisions, as suggested by the NCF, an Indian Trade Organisation should be created and allowed to function professionally and transparently.

The Food Security Act is a welcomed move and should be enacted soon. A well-defined, pro-farmer and pro-resource poor consumer Food Security Policy is an urgent necessity. A multi-stakeholder National Food Security and Sovereignty Board should be setup. It should be chaired preferably by the Prime Minister with its membership including the Minister for Agriculture and Food and other concerned Ministers of GoI, the Deputy Chairman of the Planning Commission as well as a few Chief Ministers of food surplus and food deficit States, leaders of all national political parties, a few experts including specialists in the gender dimension of agriculture and food security, and mass media representatives.

Finally, we must recognise that agriculture can not wait. The hungry child can not be named "Tomorrow". His/her name is "Today". We must act now and at this moment.

Ex-Member, National Commission on Farmers

Horticulture: The Next in Agriculture

Dr KL Chadha

India grows a wide variety of horticultural crops namely fruits; vegetables, potato, tropical tuber crops and mushrooms; ornamental crops; medicinal and aromatic plants, spices and plantation crops like coconut, cashew, cocoa, tea, coffee and rubber. Recently, the promotion of bamboo and honey bees has also been added to this group. Government of India has laid major emphasis on horticulture from mid eighties onwards as a means of diversification for making agriculture more profitable through efficient land use, optimum utilization of natural resources (soil, water and environment) and creating skilled employment for rural masses, especially women folk and these efforts have been rewarding. India has now emerged as the largest producer of mango, banana, coconut, arecanut, cashew, ginger, turmeric, black pepper and the second largest producer of fruits, vegetables and tea. Among the new crops, kiwi, olive, gherkins, Kinnows and oil palm have been successfully introduced for commercial cultivation in the country.

The production base of horticultural crops has been expanding since independence. From the eighth plan onwards, this sector has witnessed tremendous growth in area, production and productivity. The area and production under horticultural crops were 13.43 million ha and 97.83 million tonnes respectively during 1991-92, and increased to 19.33 Million ha and 185.86 million tonnes during 2005-06 (Fig 1). The increase in area, production and productivity was to the tune of 56.92, 91.86 and 28.0 per cent respectively between 1991-92 and 2005-06 (Fig 2). Changes in fruits, vegetables, flowers, spices and plantation crops during the above period has also been substantial, which is 105.2, 86.3,89.6,168.8 and 50.2 per cent respectively (Fig 3).

The area under horticultural crops has been increasing in various states. During 2003-04 coverage of area under various horticultural crops was about 19.30 million ha (Table 1.2) which is approx 10.0 per cent of the total cropped area.

The share of state output in different horticultural commodities has been increasing. Among the different states, West Bengal contributes the maximum (14.09) share of state output in horticulture. Maharashtra ranks 2nd followed by Karnataka, Kerala and Andhra Pradesh.

China is presently the world's largest fruit and vegetable producer, with a share of 34 percent, followed by India with a share of 10 percent. A modest change in world's area, production and productivity of fruits and vegetables is seen during India's III Plan to X plan period i.e. 99 per cent in area, 163 per cent in production and 32 per cent in productivity. China has recorded 1348 percent change in area, 2274 per cent in production and 64 per cent in productivity of fruits. This change was compared to 144, 199 and 22 per cent respectively for area, production and productivity in India.

In fruits, India occupies first place in production of mango, banana, pomegranate, sapota and *aonla*. The productivity of grapes is highest in the world. India has higher national average productivity in banana and sapota compared to world average

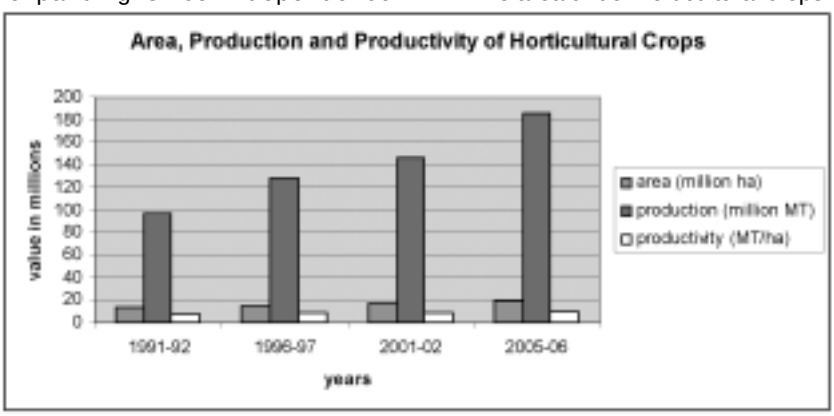


Fig1: Area, Production and Productivity of Horticultural Crops

Table 1: State share of area, output in horticulture and share in agricultural GDP during 2005-06

S. No.	State/UTs	% Area under Horticulture*	% Share of State output in horticulture	Percent share in agriculture output at 1999-2000 price
1	Andhra Pradesh	11.41	7.50(5)	29.37
2	Arunachal Pradesh	40.15	0.17	49.07
3	Assam	14.34	3.67	55.65
4	Bihar	19.63	5.49	48.96
5	Chhattisgarh	2.75	2.01	33.83
6	Goa	70.85	0.31	63.93
7	Gujarat	8.57	4.96	22.36
8	Haryana	6.50	1.50	12.62
9	Himachal Pradesh	44.85	1.83	65.44
10	Jammu & Kashmir	34.13	1.46	53.65
11	Jharkhand	4.73	1.53	51.33
12	Karnataka	12.73	9.48(3)	42.70
13	Kerala	73.33	9.09(4)	74.15
15	Madhya Pradesh	4.61	2.27	13.86
15	Maharashtra	10.23	12.41(2)	30.54
16	Manipur	57.21	0.29	48.55
17	Meghalaya	31.25	0.31	66.18
18	Mizoram	18.00	0.07	39.09
19	Nagaland	7.20	0.17	35.86
20	Orissa	20.91	4.58	45.25
21	Punjab	4.85	1.42	7.86
22	Rajasthan	14.80	1.43	8.01
23	Sikkim	58.80	0.29	80.81
24	Tamil Nadu	16.86	4.97	38.04
25	Tripura	28.47	0.71	59.33
26	Uttarakhand	15.20	0.88	40.14
27	Uttar Pradesh	6.41	6.79(6)	15.78
28	West Bengal	25.89	14.09(1)	50.96
29	Andaman & Nicobar	100.00	0.06	56.50
30	Chandigarh	10.00	0.00	50.39
31	Dadar & Nagar Haveli	9.17	0.01	17.42
32	Daman & Diu	12.50	0.00	9.00
33	Delhi	83.32	0.20	71.00
34	Lakshadweep	100.00	0.00	5.30
35	Pondicherry	31.24	0.04	35.71
36	National	13.08	100.0	31.25

** Data for 2003-04*

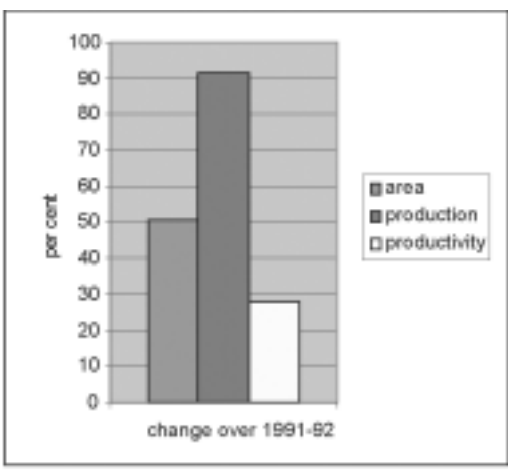


Fig 2: Changes in area production and productivity in horticultural crops between 1991-92 and 2005-06

productivity. In vegetables, India is the largest producer of okra, second largest producer of brinjal, cabbage, cauliflower, pea, onion and tomato and third largest producer of potato in the world. India is the largest producer, consumer and exporter of spices and spice products in the world and produces more than 50 spices. Chilli is the major spice crop occupying about 29% of area under cultivation and contributing about 34% of total spices production in the country. Turmeric accounts for 14% of production and 6 % of area, while garlic accounts for 19% of production and 5% of area. Seed spices contribute 17% of production and occupy 41% of area while black pepper contributes 2 % of production and occupies 9 % of area of the total spices in the country.

As per FAO statistics India's productivity is ranked 64th in case of fruits while 109th in case of vegetables. In flowers, West Bengal leads with a production of 8,963 lakh cut flowers followed by Karnataka with 4,134 lakh. Tamil Nadu is the leading producer of loose flowers closely followed by Karnataka both in terms of area and production. India is a home for many medicinal plants/spices having an estimated area of 2,72,150 ha under important medicinal plants.

India accounts for 22.34% of the world's coconut production and is one of the major players in the global coconut trade. In Cashew, India is the largest producer, processor, consumer and exporter. India's share in the world raw nut production accounts to about 25%. It is a leading producer of areca nut and accounts for 56 and 58% of

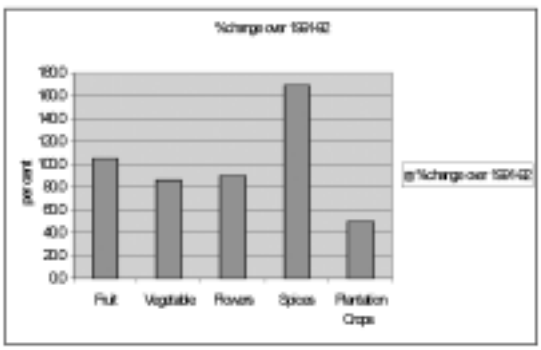


Fig 3: Changes in production of fruits, vegetables, flowers (from 1996-97), spices and plantation crops over 1991-92 to 2005-06

Table 2: Top 5 countries in fruits and vegetable productivity in the world during the year 2006

Rank	Fruits		Vegetables	
	Country	Productivity (kg/ha)	Country	Productivity (kg/ha)
1	Belgium	32961.5	Iceland	64796.61
2	Guatemala	30656.7	United Arab Emirates	58773.81
3	Netherlands	30634.1	Kuwait	49446.37
4	Costa Rica	27382.9	Netherlands	44453.64
5	Japan	23984.5	Ireland	41002.54
6	USA	23535.1	Austria	38051.82

Source: FAOSTAT, 2008

the total area and production in the world. Arecanut industry forms the economic backbone of nearly 10 million people of India and for many of them it is their sole means of livelihood. The country produces areca nut valued at Rs. 3,000 crores annually.

India is the second largest producer and the largest consumer of tea in the world with 19 % share in area and 27% share in production. India consumes about 23.5% of total world consumption of tea, which constitutes about 81% of the tea produced in the country.

Coffee covers an area of 3.80 lakh ha in its traditional coffee tract confined to the states of Karnataka, Kerala and Tamil Nadu. However our productivity compared to Vietnam (in Robusta) and Brazil (in Arabica) is less.

GROWTH TREND

The growth trends of area production and productivity of horticultural crops during the past three plans are given in the Fig. 2. The increase in area which was 2.3 and 2.43% during the VIII and IX Plan significantly went up to 6.6% in the X Plan. Since a major part of the area under most perennial crops takes 5-6 years to come to bearing and an equal number of years to attain peak bearing, the area expansion is yet to suitably make a difference in either total production or productivity per unit area (Fig 1).

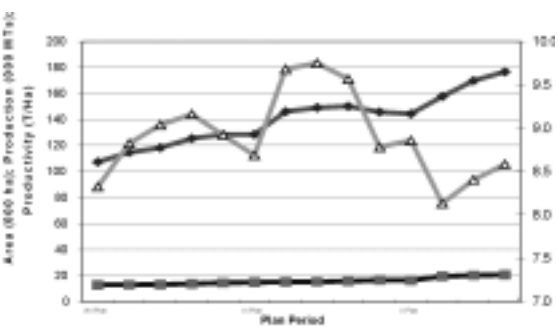


Fig. 4. Growth trends in horticulture sector

Growth of agricultural GDP decelerated from over 3.5% per year during 1981–82 and 1996–97 to only around 2% during 1997–98 and 2004–05. This deceleration, although most marked in rainfed areas occurred in almost all States and covered almost all major sub-sectors, including those such as horticulture, livestock, and fisheries, where growth was expected to be high. As a result growth of agricultural GDP has been well below the target of 4% set in both the Ninth and Tenth Plans. Among the growth rate in output of various sub-sectors of agriculture, fruits and vegetables have been superior as compared to other sub-sectors over different periods indicated in the Table 3.

Table 3: Growth Rate in Output of Various Sub-sectors of Agriculture
(Gross Value of Output at 1999-2000 price)

Period	All horticultural crops*	Fruits and Vegetables	All Crops	Cereals	Pulses and Oilseeds	Livestock	Fishery
1951–52 to 1967–68	2.65	2.67	3	4.19	2.98	1.02	4.68
1968–69 to 1980–81	4.16	4.82	3	3.43	0.97	3.26	3.08
1981–82 to 1990–91	2.54	2.84	2.97	3.52	5.41	4.78	5.74
1991–92 to 1996–97	5.99	6.07	3.09	2.36	2.92	4.00	7.05
Ninth Plan 1997–98 to 2001–02	4.04	4.11	2.25	1.49	–1.43	3.53	2.63
Tenth Plan 2002–03 to 2006–07	2.99	2.97	2.46	1.28	4.29	3.69	3.23
of which 2002–03 to 2004–05	1.17	0.30	0.42	–1.27	5.95	3.32	1.77
2005–06 to 2006–07	4.10	6.97	5.53	3.52	1.61	4.23	5.49

Source: New Series of National Accounts Statistics, Central Statistical Organization, Ministry of Statistics and Programme Implementation, New Delhi.; cited from planning commission document 11th plan and *compounded annual growth rate, Author's calculations

R&D INVESTMENTS

The past efforts in the investments in this sector have been rewarding and India is fast emerging as a horticultural force to be reckoned as a leader within the global arena. Starting with a meager financial allocation of Rs. 2.05 crores for horticulture development in the IV Plan, the Plan allocation rose to Rs.7.62 crores in V, Rs. 14.64 crores in VI, Rs. 25.0 crores in VII, Rs. 1000.00 crores in VIII (utilization Rs.789.0 crore) and Rs.1453.06

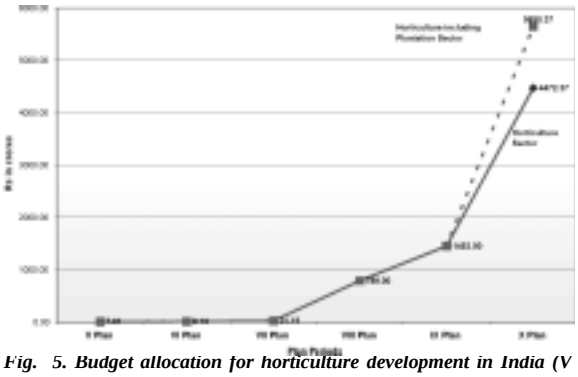


Fig. 5. Budget allocation for horticulture development in India (V - X Plan)

crores in IX Plan Total budgetary allocation for the development of horticulture and plantation sector in the country during X Plan period was Rs. 5,650 crores; of this an allocation of Rs. 4,472 crores was made to Ministry of Agriculture which was nearly three times the allocation of Rs. 1,453 crores during IX Plan. In addition Rs. 1,178 crore was allocated to the different commodity Boards under the Ministry of Commerce dealing with Tea, Coffee, Rubber and Spices. Similarly for research, the investment by the ICAR in the central sector has increased significantly during plans. The plan allocation for horticultural crops started in IV Plan (1969-74) with a modest allocation of Rs. 3.48 crores and was enhanced to Rs. 31.96 crores in the VII Plan (1985-90), Rs.104.7 crores in the VIII Plan (1992-97), and Rs 213.0 crores in the IX plan (1997-2002) and to Rs 408.0crores in X Plan (2002-2007).

While the increase in the budgetary allocations from IV to X Plan was 117 times for research, it was 5800 times in respect of the development programmes. At present the horticultural crops programmes form around 30 per cent of the total outlay of agriculture development of the Department of Agriculture & Cooperation besides allocation to the Ministry of Commerce and allocation for research is about 7.6 per cent of the total outlay for agricultural research made by the ICAR. There has been a quantum jump in the allocations for the horticulture sector during the XI Five Year Plan which is Rs 14966 crores and has a share of 27.31 per cent in agriculture.

RESEARCH AND DEVELOPMENT INFRASTRUCTURE

India has a strong institutional support for R & D programmes in Horticulture. Horticulture research in India received a boost with the establishment of the Indian Institute of Horticultural Research at Bangalore and starting of eight All India Coordinated Crop Improvement Projects to cover different horticultural crops in 4th five year Plan (1969-74). Rapid expansion of infrastructure took place in 7th and 8th Plans. Today, India has dedicated research infrastructure by way of 10 Central Institutes with 27 regional stations, 12 crop specific National Research Centres, 9 Multi-disciplinary Institutes, 13 All India Coordinated Research Projects with 223 centres. Two full fledged State Universities on Horticulture (each in Himachal Pardesh and Andhra Pradesh), 28 State Agricultural Universities and 15 central/ general/deemed to be universities with Horticulture discipline, 5 network projects, 29 Revolving fund schemes which deal with research on different horticultural crops. Besides the above a large number of CSIR laboratories and Centres aided by Departments of Biotechnology (DBT), Bhabha Atomic Research Centre (BARC) and Indian Space Research Organization (ISRO) are also undertaking basic and strategic research on horticultural crops. The Ministry of Commerce has established one Research Institute each for Coffee, Rubber and Spices and two for Tea which work on different aspects of these commodity crops.

The Department of Agriculture and Cooperation (DAC) in the Ministry of Agriculture, the nodal department for horticulture development in the country has two directorates each on Cashew nut and Cocoa; and Arecanut and Spices located at Cochin and Calicut (Kerala) besides three autonomous boards, National Horticulture Board, Coconut Board and Bee Board. In addition, ICAR with 557 Krishi Vigyan Kendras, the Ministry of Commerce through the Commodity Boards -Spices Board, Tea Board, Coffee Board and Rubber Board, respectively promote development in horticulture sector. Agriculture and Processed Food Products Export Development Authority (APEDA) under the aegis of the Commerce Ministry promotes export of horticultural commodities both fresh as well as in processed form. Indirect organizational support for horticulture development is also being provided by two agencies in the Ministry of Agriculture namely National Cooperative Development Corporation (NCDC) and National

Table 5: Status of Indian horticulture exports

Commodities	1995-96 Value (Rs in Crores)	2005-06 Value (Rs in Crores)	% Increase over 1995-96	2011-12 Projected Value (Rs in Crores)
Fruit & Veg Seeds	43.08	92.87	115.58	149.57
Floriculture	60.14	301.44	401.23	485.47
Fresh Fruits	229.93	1120.68	387.40	1804.87
Fresh Vegetables	301.19	919.8	205.39	1481.35
Processed Fruits & Veg.	491.57	1093.24	122.40	1760.67
Coconut & its products	211.56	552.09	160.96	889.15
Arecanut	3.6	9.46	162.78	15.24
Cocoa	8.86	24.8	179.91	39.94
Cashew	1240.5	2593.35	109.06	4176.62
Spices	804.44	2115.92	163.03	3407.71
Tea	1244.52	1730.7	39.07	2787.31
Rubber	278.44	274.51	-1.41	442.1
Coffee	1527.16	1588.66	4.03	2558.55
Total	**6444.99**	**12417.52**	**92.67**	**19998.54**

Agricultural Cooperative Marketing Federation (NAFED) and its institute National Horticultural Research and Development Foundation (NHRDF). Besides almost each state has a separate department of Horticulture to promote the scheme of central and state governments.

PROGRAMMES FOR HORTICUTURE DEVELOPMENT

Five new development programmes were launched during the Xth Plan to achieve overall development in horticulture namely, technology mission for integrated development of horticulture in the north east region & Himalayan states, national horticulture mission, national bamboo mission, micro-irrigation mission and Central Institute of Horticulture. These programmes together have invested Rs 2400 crores during X Plan. These programmes have been continuing during XI Plan with budgetary support of Rs 14,134 crores.

HRD IN HORTICULTURE

Nearly one fifth (21.6 per cent) of the total strength of agricultural scientists are working on horticulture crops, which amounted to a total of 3575 scientists as per a census during 2001-02. Public sector contributes the majority of research scientists, which is about 91 per cent. Indian Council of agricultural Research contributes about 26 per cent, while SAUs contribute about 65 per cent and the remaining 8.5 per cent are in the private sector. Two full fledged state horticultural universities and 16 new colleges of Horticulture in different state agricultural universities are opened in recent years to generate technologies and impart education to create trained manpower for horticulture development of the country. Similarly there has been spurt in horticulture literature both for R & D workers and growers.

HORTICULTURE EXPORTS

India is exporting fresh fruits, vegetables, processed products of fruits and vegetables, cut & dried flowers, medicinal and aromatic plants, seeds, spices, cashew kernels and their products, tea and coffee. The total value of export of these commodities increased from Rs.29723 million in 1991-92 to 64,450 in 2001-02 to 124175 million in 2005-06. Horticulture produce and products accounted for about 35 per cent of the total value of exports of agricultural commodities from India during 2005-06. Of these, export of cashew leads all horticultural commodities followed by spices, tea and coffee. During past one decade the maximum increase in exports was observed for floriculture (Table).

Horticultural Imports

The import value of all horticulture products in 2003 was of the order of US$ 1.06 billion. There has been about a three fold increase in the import value in the last one decade which is attributed mainly to the phasing out of quantitative restrictions. Starting in the second half of the 1990s imports of fresh fruits, especially apples, have risen considerably by more than 245% per annum (1997-2003).

Growth has also been rapid for certain processed food products like apple juice and dried vegetables, though the single most dominant item in this category continues to be dried peas. The trade has reported that about 1,000 containers of apples were imported for Diwali gifts in 2006. To protect H.P. apple from competition from Chinese apple, it may be relevant to declare apple as a special product and fix quota for its import. However, import penetration remains insignificant in terms of the share in total consumption. For fresh fruits, it is less than 0.1% of domestic production, and is also negligible for most fresh vegetables. However, the apples and other fruits which are being imported in India need to be test checked to ensure that they are free from pests and diseases and do not pose any threat to the domestic systems of production.

Import of some commodities is adversely affecting the domestic market. For instance unchecked import and rampant adulteration of saffron from Iran is pushing prized saffron production in Jammu and Kashmir to the verge of extinction.

RESEARCH ACHIEVEMENTS

A lot of research achievements have been made in horticultural during recent past. As a result, the horticulture scenario of the country has been changing from a producer to a global leader. Major achievements made in different horticultural crops/crop groups during the past two decades are given below.

i. Crop Improvements

Several new crops have been introduced for commercial cultivation, eg. Kiwi fruit in sub-mountain areas of North India, Olive in mid hills of North Western Himalayas, Low chilling stone fruits in the North Western plains and others. Over 50 varieties in different fruit crops including Pusa Arunima, Ambika,

Sindhu in mango; Udhayam in banana, Rubi and Arakta in pomegranate Surya in papaya, Goma Kirti in ber etc have been developed. In ornamental plants, presently, 57 varieties of rose, 35 of chrysanthemum, 42 of gladiolus, 150 of bougainvillea, 25 of hibiscus and 2 of orchids are available for commercial adoption.

ii. Biotechnology

The last two decades one has witnessed unprecedented technological advances in biological sciences/the techniques of plant tissue culture, recombinant DNA technology and DNA based markers. Over 1,500 germplasm accessions and being maintained and exchanged from *in vitro* repository and transgenic crops like potato have been developed.

iii. Propagation of Planting Material

There has been a substantial improvement in vegetative propagation techniques of fruit and plantation crops and seed production technologies in vegetables and flowers crops.

iv. Micro propagation

Micropropagation has been standardized and it has also been commercialized in few crops. *In vitro* propagation protocols available for different MAPs like *Rauvolfia serpentina* (Sarpgandha), *Dioscorea floribunda* and several others.

v. Improved Production Technologies

Some of the key technologies developed for commercial adoption are listed hereunder viz, High density planting systems standardized in mango, banana, Kinnow, pineapple and papaya for higher productivity & profitability. Rejuvenation technique for old and senile plantations in mango and cashew standardized and being adopted. Drip irrigation/ fertigation in banana, grape, papaya, pomegranate, mandarin, coconut, areca nut and cashew standardized for saving water and fertilizer by 30 to 40 % with increases in yield and fruit quality.

vi. Plant Protection

Plant protection schedules established for all commercially cultivated horticultural crops. Biological control methods standardized for control of mealy bug in grape, scale insects in citrus, rhinoceros beetle and leaf eating caterpillar in coconut. Integrated Pest Management (IPM) strategies in crops like cabbage (diamond back moth), tomato (fruit borer), potato (bacterial forecasting and tuber moth) standardized. Apple scale and potato late blight forecasting systems have been developed. Twenty four IPM packages including those for fruits, plantation and spice crops have also been developed for farmers. Improved disease detection techniques such as ELISA and ISEM for different horticultural crops have been developed.

vii. Post Harvest Management

Standardization of pre- and post-harvest chemical treatments to control post harvest diseases in citrus, mango and banana for long distance transport and storage. Semi-processed products like tomato puree, ginger, garlic and chilli pastes are now available in super markets.

CONCLUSION

Horticulture development in the country was taken seriously in 80's with a realization that diversification to horticulture crops is the major option to improve livelihood security of small farmers, improved employment opportunities, to attain food and nutrition security, improve income through value addition and foreign exchange through exports. Different programmes have been in operation and significant developments in produce/products and exports have taken place. Budgetary and institution allocation have increased considerably over the time. Both production and productivity of several crops has increased manifold. Many new crops have been introduced many others have adapted to non conventional areas. Export of fresh as well as processed fruits has been increasing. The demand of horticulture produce is on the rise due to increasing population, changing food habits, realisation of high nutritional value of horticultural crops and greater emphasis on value addition and export. There are still several challenges to strengthen the horticulture research and development of the country. In order to meet the challenges ahead major emphasis has been suggested to be laid on prioritization of research objectives, ensuring availability of quantity and quality of the plant material, priority crops to meet the future needs, protected cultivation to improve the productivity levels, organic farming for capitalizing the niche markets, mechanization to bring efficiency and competence, post harvest infrastructure to match the mammoth expansion, value addition to venture into new products, transfer of technology to make the extension system more accountable, radical reforms in database management, venturing in to new opportunities like GMO's, Pharmaceutical and nutraceutical compounds, branding of Indian horticulture produce etc. Horticultural crops has bridge the yield gaps and has brought prosperity even in arid and semi arid areas. Horticulture is no longer a leisurely avocation and is fast assuming position of a vibrant commercial venture. India has now emerged as an important country in the world horticulture. With a lot of development in recent past, horticulture status in India is now ready to be reckoned as GOLDEN REVOLUTION.

Ex DDG, Horticulture, ICAR

Sustainable Agri-Businesses

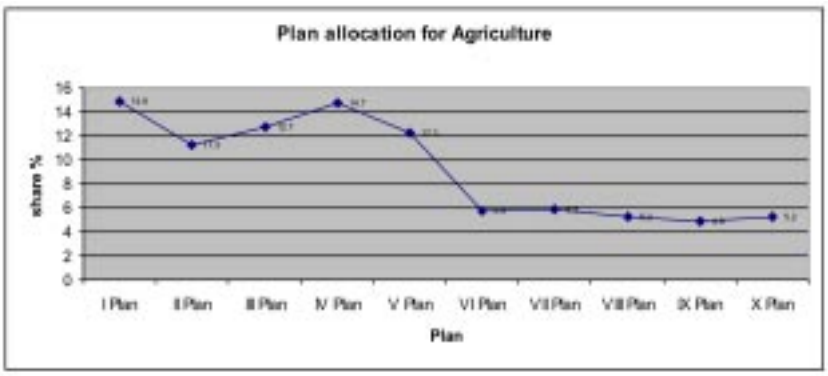
Market Imperatives in the Value Chains

Dr CS Sundaresan

Introduction

Declining farm sector performance – in addition to its deleterious economic ramifications- causes large scale rural distress which often ends up in farmer suicides. This distress conveys much on the economic rationale ruling the agri and rural domains for its incompatibility in the changing environments. Given the structural lag and the system complexities, many feel that commercialized agriculture with adequate levels of technological, credit and marketing interventions requires the induction of value added agri-businesses with proper risk cover. Farmers perceive risks differently given the farm ambience and the modes and relations of production works in the spatial unit. In reality, the major risk that Indian farmer faces are emanating from internal variables. This includes non-availability of quality seed, supply constrains of fertilizers and pesticides and lack of extension services. The exploitation at the farm level is a major risk for Indian farmers to tackle with. This works as a major hurdle for agri-businesses to operate on competitive grounds. Hence, one needs to look at a matrix (scenarios) which will help farmers as well as agri-businesses to determine the adoption levels. The scenarios should be able to guide the farmers as well as businesses to determine the crop options as well as value addition strategies from a market perspective. This also will work as means to avert the external uncertainties like market.

Chart 1. Declining Plan Allocation for Agriculture sector



Source: FY Plan Documents, Government of India, Various plans

Value chains and demand driven agriculture

Rapid growth in the agricultural sector can come through the creation of growth engines in rural businesses / agri-enterprises (Value Chains). It has to foster around newer agricultural practices for production and the establishment of processing (Value addition) centers facilitating a shift of farm dependent people to allied areas, thereby creating employment and income. Another important interven-tion imperative in this context has been the diversification into high-value crops and value addition to both traditional and diversified agriculture produces. Value addition can bring about dramatic improvements in the agricultural value chains and result in higher incomes at different points of the rural economy. The major value chains in the vertical and horizontal domains for enhanced competitiveness of the agriculture and businesses are as follows.

A.Vertical

Food processing, Fruits & Vegetables, Floriculture, Dairy, Poultry, Fisheries, Meat, Bio-Fuels and Plantation crops

Farm Risk scenarios	
Low Investment – Low risk	High Investment – Law risk
Low Investment – High risk	High Investment – High risk

B. Horizontal (Cutting across all value chains)

Policy rationalization, Market linkages, Investment promotion, Financing and risk Management, International linkages, Production productivity and Inputs

Why are these value chains not taken off? One of the main reasons in this context has been the food security concerns. The dilemma currently therefore is that whether it is really worthwhile to hold the farm sector for food security? The inward looking paradigm claims that agriculture essentially caters to the food security and hence, supply side approach to agriculture is rational from the point of view of conventional management. From an overall national economy perspective, the progressive thought school observes the potential of the sector for enhanced growth, if a paradigm shift is brought in the operational spheres.

Having said the above, what should be the ideal policy that will balance the food/livelihood security and crop diversification, which can foster an ambience for value adding agri-businesses in India? It is desirable in this context to understand the current policy roadblocks for crop diversification and agri-businesses. Despite sizable growth in areas under commercial crops including vegetables and fruits since early 50s, its' momentum could not be established for any agri businesses to depend for the raw materials. However, this sector has gained momentum in the last decade in terms of increased area and production. The major segments in this growth engines are vegetables, fruits and also to some extent commercial crops like sugar cane, cotton and oilseeds- especially soybean. There are however, constraints identified in its faster expansion viz; (a) Fragmented land holding (b). Inadequate post-harvest agri market infrastructure and market mechanisms (c) Weak research - extension - farmer linkages (d) Declining public investments (capital formation) in the sector and (e) the lack of a vertically integrated farming systems. It is worthwhile to mention in this context that the plan allocation for agriculture sector has been declining (Chart 1) over the years.

It goes without saying therefore that establishment of systems for diversification of agriculture will enable the development in allied sectors such as Livestock, Dairy, Poultry, and Fisheries to generate additional income to the Farmers. It will facilitate large-scale exports of high value basic and processed agri produce. Establishing the agri value chains in vertical and horizontal spheres through effective market linkages hold the key for the farm sector growth for its contribution to the SDP/GDP. The other set of factors that hinder farmer's linking with the markets are Poor Marketing Infrastructure, Supply Chain Infrastructure (Including Cold Chain Infrastructure), Lack of Agricultural Marketing Information System for Farmers, awful transportation facility and road connectivity and Weak network of modern telecom infrastructure in remote areas.

Chart 2. Crop composition –1990-91

Chart 3. Crop Composition -2005-06

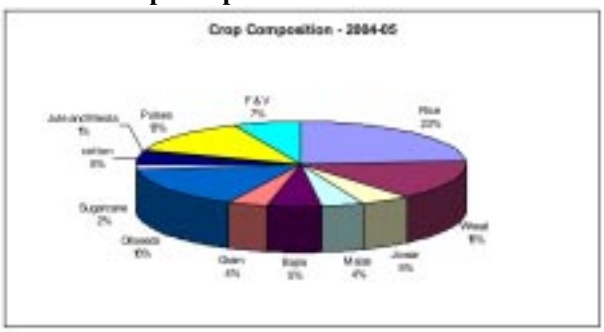


Chart 4.Commodity- export Basket 1990-91

Chart 5.Commodity- export Basket 2004-05

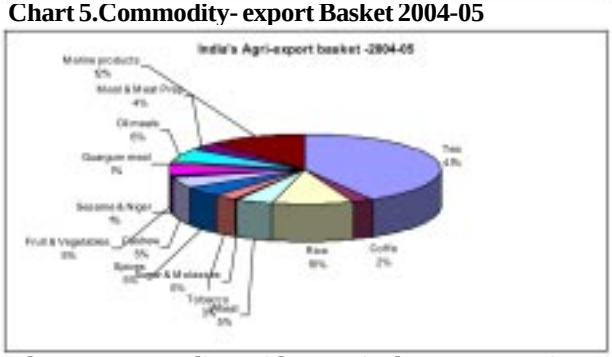


Chart 6.Commodity-Inida's Agriculture exports since 1990

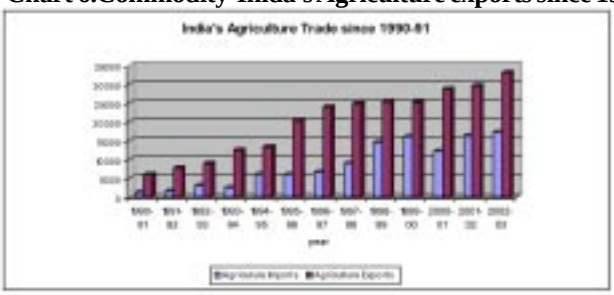


Table 1. Exports of Agriculture and other products from India 2007

($US million)

Commodity	2007	% Growth over 2006	% share of exports
Agriculture & allied Products	8548.36	18.42	6.77
Plantation	866.77	15.61	0.69
Marine Products	1742.27	9.63	1.38
Cereals	1692.28	3.59	1.34
Pulses	168.72	-33.02	0.13
Oil Meals	1215.19	10.36	0.96
Castor Oil	239.36	12.77	0.19
Processed Foods	1203.18	26.31	0.95
Fresh Fruits & Vegetables	638.26	38.49	0.51
Sugar & molasses	703.27	420.75	0.56
Meat and Preparations	715.41	15.17	0.57
Poultry & dairy products	176.22	-29.59	0.14
Floriculture Products	84.12	23.55	0.07

Source: UK India Business council, 2008

The obvious postulate is that, interplay of market and prices can incentivise farmer better than subsidies and therefore demand driven farming systems would be able to balance the food requirement and value addition. Moreover, one need not unduly be preoccupied with cereals given the fact that consumption baskets of rural and urban population have been changing structurally. The shift in consumption from the traditional grain based food to value added food items signals the need for fostering a vibrant agri-business domain within agriculture.

NAP 2000 and the Quiet Revolution in Agri-Business space

The National Agriculture Policy announced in July, 2000 brought in a renewed thrust to break the inherited inward looking approach in Indian farm front. The new policy strategically targeted at de-linking India's agriculture from a food supply perspective and focuses it towards a market perspective for value addition, growth, equity and inclusiveness. It included the alignment of production and distribution systems to benefit the farmers as well as consumers through the mediation of markets. The new Policy framework hence sought to actualize the vast untapped growth potential of Indian agriculture - strengthening rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agri businesses, create employment in rural areas, secure a fair standard of living for the farmers and agricultural workers and their families, discourage migration to urban areas and face the challenges of inequality arising out of economic liberalization and globalization. The new policy envisaged to attain a growth rate in excess of 4% per annum over the next two decades. It therefore included conserving soil, water and bio-diversity and recognized that growth needs to be demand driven and it should cater to domestic markets and maximize benefits from exports of agricultural products in the face of the opportunities emerging from economic liberalization and globalization. Ultimately, it targeted to growth, which is sustainable - technologically, economically and environmentally.

India has witnessed a quiet revolution in the agriculture sector ever since the policy intervention or a little prior to this as an overall effect of the economic liberalization programs. This revolution has been in the spheres of crop composition as well as the agriculture trade. For instance, there has been significant growth in the high value agriculture. The major crop segments within the high value space are Fruits, Vegetables, Floriculture, spices and plantation crops. There is a significant increase in the area and production of fruits in India. The Vegetables sector registers high growth in terms of area, production and productivity. Floriculture crops also register high levels of growth in area, production and yield. Spices crops are growing at very impressive rate of 6.98% and 7.33% in terms of area and production respectively. This has been driving Indian

agriculture to a demand led growth track with higher export potential. Consequently, the composition of agriculture trade also has been undergoing structural change.

It is however true that agriculture trade is yet to claim an impressive share in the total merchandise of the country. For instance, the share of agriculture and allied products in the total exports is around 6.5%. This perhaps is an indicator of the inadequate levels of value addition and the low global competitiveness of Indian agri-value chains. The share of agriculture and allied products in the export basket of India stands at 6.77% as of 2007. What explains this level of performance of agri-sectors in the total business of the country perhaps is the gradualism India adopted in its farm front, for reasons of political sensitivity. Further it is hampered by the investment constraints for global stakeholders and the retailers.

With this state of affairs, the government is constantly pursuing measures to pull up the agri-business sectors. For instance, the new trade policy increased its focus on agro-based industries. Food processing industries have been put in the list of priority sectors for bank lending. Fruit and vegetable processing units have been completely exempted from paying excise duty. Automatic approval for foreign equity up to 100% is permitted for most of the processed food items. Items like fruits and vegetable products, condensed milk, ice cream, meat production etc. have been completely exempted from Central Excise Duty. Excise duty on ready to eat packaged foods and instant food mixes has been brought down to 8% from 16%. Excise duty on aerated drinks has been reduced to 16% from 24%.

Investments in the agro-processing sector are looking for a boost. The 'India Food Report 2008', reveals that the total amount of investments in the food processing sector in the pipeline for the next three years is about US$ 23 billion. The government has received around 40 expressions of interest (EoI) for the setting up of 10 MFPs with an investment of US$ 514.37 million. Adani Wilmar, the owner of Fortune edible oil brand, is eyeing acquisitions of greenfield and brownfield assets for sunflower, soya and mustard oil projects. It plans to invest close to US$ 199 million in these projects over the coming years. Reliance Industries Ltd has invested US$ 1.25 billion in dairy project. Britannia Industries Ltd. has signed an agreement with Fonterra Brands (Mauritius Holding) to acquire Fonterra's 49% equity and preference shareholding in Britannia New Zealand Foods, their dairy joint venture.

Conclusion

It is generally agreed that India possesses outstanding competitive advantages in agriculture compared to others. First, it has zones, which are climatically favorable for cultivation of every commercially important plant species. Second, it possesses the largest acreage of irrigated land with potential still to be tapped. Third, the gap between present productivity and proven technological potential is very large for most crops. Fourth, the state has skilled, educated, technical and scientific manpower. These diverse advantages call for location-specific and crop-specific strategies to leverage the domestic and global competitiveness. What is required is the source to leverage the potential in the sector through its value addition and market linkages.

The second phase of agriculture reforms is due in the country and the states hold the stake in establishing the value chains and linking those to the markets for enhanced income and thereby livelihood security of the people. The changing consumption patterns in rural and urban segments suggest that the food basket will continue to diversify with the rise in the per capita incomes. Hence the policy needs to be pro-crop diversification and high value agriculture. Agri value chains are to be pulled up and linked to the markets by the mediation of processing industries in a risk free environment as a strategic way forward in the agri-business sectors for growth and sustainability.

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THE NATIONAL FOOD SECURITY MISSION A MAJOR STEP FORWARD

Dr NB Singh[1] & Dr JP Mishra[2]

Dr NB Singh

FOOD SECURITY CONCERNS

The issue of food security has been a serious concern in recent times as the global foodgrain production is not keeping pace with increasing population. There is also a horizontal and vertical diversification of foodgrains particularly towards animal and poultry feed, industrial uses and recently towards biofuels. This indicates that the foodgrains will be under enormous pressure and global food security will be at stake in years to come. The changing climatic factors particularly, the rainfall pattern and the temperature regime will also have an impact on foodgrain production and the food security.

The population of our country is projected to attain the level of 1200 million by 2011. On one hand we have sufficient foodgrains in our buffer stock, on the other, over 260 million people are grossly undernourished. The production of foodgrains increased from 50.42mt in 1950-51 to the highest ever of 234mt in 2008-09.

The primary forces that triggered this phenomenal growth are technological breakthrough with evolvement of input responsive and photo and thermal insensitive new plant types of crops with strong back up of infrastructural development for increase in irrigation coverage from 20.85mha in 1950-51 to about 58.54mha in 2004-05 and very steady growth in fertilizer consumption from about 0.07mt in 1951-52 to 22.04mt in 2006-07 which enabled the farmers to intensify their cropping pattern. The infrastructural development in transportation, energy, marketing, and processing and value addition also contributed directly and/or indirectly for the agricultural growth.

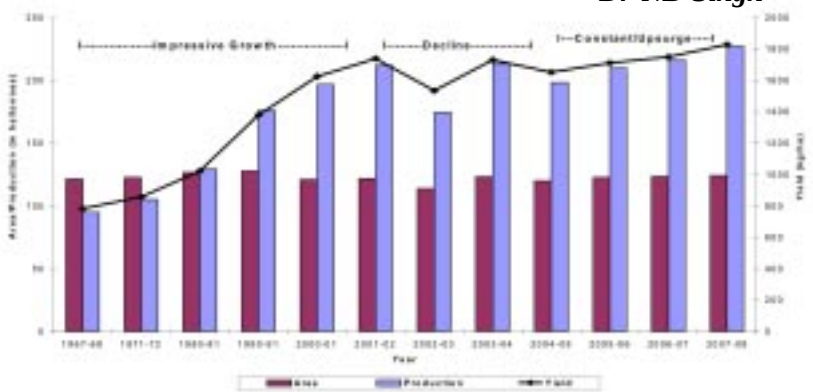

Figure 1: Area, production and yield of Foodgrains (1967-68 to 2007-08)

REQUIREMENT AND PRODUCTION PROSPECTS

The consumption requirement alone of food grains for 1200 million population likely to happen in 2011, on normative requirement at 182.50kg/cu/per year, comprising 167.90kg cereals and 14.6kg pulses, as recommended by National Institute of Nutrition (NIN), Hyderabad, works out to 204.75mt which in terms of production requirement would be about 234mt, assuming seed, feed and wastage as 12.5% of the gross output. The Planning Commission has also estimated the foodgrain requirement to the tune of 236mt by 2011-12.

ICAR estimated the country's foodgrain requirement in 2020 at about 256mt, comprising 112mt of rice, 82mt of wheat, 39mt of coarse grains and 22mt of pulses. The demand for edible oils will be about 11mt. To achieve these levels of production, the growth rate of domestic output should accelerate to 3.5 –to 4% p.a. from the existing level of 2.4%.

Table1: Estimated demand for foodgrains and edible oils

Item	Achieved TE 2002-03 to 2004-05			Demand in 2020 (mt)		Yield target in 2020	
	Area (mha)	Production (mt)	Yield (Kg/ha)	LIG	HIG	LIG	HIG
Rice	42.2	85.7	1903	112.4	111.9	2664	2652
Wheat	26.2	69.1	2582	82.3	79.9	3137	3045
Coarse cereal	30.7	30.4	1041	38.9	37.3	1268	1214
Cereal	99.1	185.2	1814	233.6	229.0	2357	2311
Pulses	21.7	13.8	608	22.3	23.8	1029	1095
Foodgrains	120.8	199.0	1595	255.9	252.8	2119	2092
Edible oil	28.6	6.4	269	10.8	11.4	379.7	399

LIG: Low income growth 3.5% per capita GDP growth
HIG: High income growth 5.5% per capita GDP growth
NB: Demand includes export 4.7mt rice and 3.6mt wheat

THE CURRENT FOODGRAIN PRODUCTION SCENARIO

The area, production and yield of foodgrains increased progressively up to 2001-02 barring few abnormal years marked by acute moisture stress (drought)

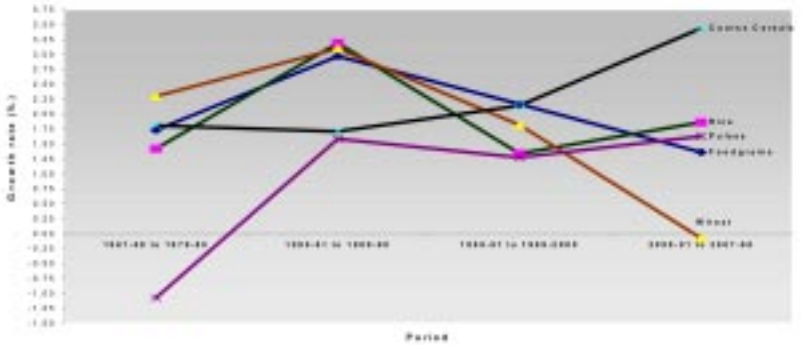

Figure 4: Decadal growth in yield of cereals, pulses and Foodgrains (1967-68 to 2007-08)

and/or heat stress. Thereafter, stagnation or decline in area and production and also in the yield was recorded due to low rainfall, intermittent long dry spells in kharif affecting severely the rice, coarse cereals and kharif pulses production (in 2002-03 , 2004-05) and abnormally high temperature as happened during the winter season of 2004-05 and 2005-06 which affected wheat production. However, during the last two years, the production of rice, wheat, pulses and coarse cereals has increased primarily due to acceleration in yield.

The production of rice has also increased significantly over the years with highest ever 95.68mt estimated in 2007-08 and 99.35mt in 1998-09. The production of wheat has also showed similar trend except in the productivity which has been stagnant since 2000-01. The pulses production has increased marginally from 12.10mt in 1967-68 to 15.19 million tones in 2007-08. The production of coarse cereals has increased from 28.8mt in 1967-68 to 39.67mt in 2007-08, inspite of the area reduction by 18.79mha.

GROWTH TRENDS AND EMERGING SCENARIO

The growth in yield of rice, wheat and total foodgrains was highest during 1980-81 to 1989-90 which declined during the period 1990-91 to 1999-2000 and remained almost constant during the last 8 years. In case of wheat, the yield reduced constantly since 1989-90.

The highest growth of 2.73% per annum in production was recorded during 1980-81 to 1989-90 even though the area declined by 0.23% per annum. This happened due to an impressive growth in yield (2.97% per annum) during the period. During 1990-91 to 1999-2000, the growth slowed down to 2.09% in production and 2.17% in yield, while area recorded negative growth of -0.08% per annum. The growth in production and yield further dipped to 1.90% and 1.36% per annum during 2000-01 to 2007-08 though the area gained marginally. The highest growth in production and yield has been achieved during 1980-81 to 1989-90, whereas the highest growth in area has been achieved during 2000-01 to 2007-08.

The present growth in productivity (2000-01 to 2007-08) in rice, pulses, coarse cereals and total foodgrains has been around 1.87, 1.63, 3.44% per annum,

Table3: Frontline Demonstrations yield and actual yield of rice and wheat in different States ***(2003-04 to 2004-05)***

State	Improved practice (t/ha)	Farmer Practice (t/ha)	Actual 2003-04 (t/ha)	Gap % between I and F	I and A
Rainfed (upland) Rice					
Chhattisgarh	3.74	3.13	1.45	19.2	157.0
Jharkhand	2.29	1.38	1.69	66.1	35.2
Uttar Pradesh	3.62	2.48	1942	46.0	86.4
Rainfed (shallow lowland)					
Assam	4.52	2.55	1.53	77.3	194.7
Chhattisgarh	3.55	2.78	1.45	27.7	144.2
Jharkhand	3.480	2.30	1.69	51.3	105.3
UP	3.65	3.43	2.18	6.5	67.2
Irrigated					
hhattisgarh	3.91	3.13	1.45	24.9	169.4
Bihar	4.88	4.15	1.51	17.4	222.1
Gujarat	5.58	4.89	1.89	14.2	195.3
J&K	7.48	4.70	1.94	59.1	285.8
UP	7.05	5.20	2.18	35.6	222.4
Uttarakhand	3.85	3.20	1.94	20.3	98.2
Wheat					
Uttar Pradesh	4.20	3.32	2.79	26.5	50.5
Bihar	3.65	2.90	1.78	25.7	104.8
Punjab	4.46	4.03	4.20	10.6	6.1
Haryana	4.75	4.52	3.96	5.1	19.8
Rajasthan	3.94	3.72	2.79	6.0	41.3
Gujarat	4.03	3.49	2.68	15.6	50.5
Madhya Pradesh	3.29	2.47	1.78	33.4	84.3
Maharashtra	3.41	2.90	1.33	17.3	155.5

Table4: Frontline Demonstrations yield and actual yield of maize and sorghum *(2003-04 to 2004-05)*

State	Improved practice	Farmer practice	Actual 2003-04	Gap % between I and F	I and A
Maize					
Bihar	3.71		2.37		56.6
Chhattisgarh	4.02		1.38		190.7
Himachal Pradesh	3.54		2.44		45.1
Jharkhand	2.60		1.60		62.1
J&K	3.69		1.65		122.5
Karnataka	3.31		2.01		64.8
Madhya Pradesh	4.57		2.05		122.5
TN	4.88		1.56		211.5
Uttar Pradesh	3.73		1.39		168.4
Sorghum					
Andhra Pradesh	2.40	1.51	1.14	58.8	109.8
Gujarat	2.13	1.41	1.00	50.9	112.1
Karnataka	1.50	1.21	0.47	23.3	219.0
Madhya Pradesh*	1.51	0.98	1.33	53.5	13.3
Maharashtra	1.83	1.24	0.72	47.5	151.9
Rajasthan*	1.91	0.61	0.71	212.7	167.6
Tamil nadu	1.83	1.35	0.61	35.5	200.2
Uttar Pradesh*	1.75	1.12	1.00	56.5	74.8

* relates for kharif season only

respectively which need to be stepped up to about 3.5% by 2011-12.

PROSPECTS -EXPLOITABLE YIELD RESERVOIR

The data given shows that there is vast gap between the realized and realizable yield at farmers' fields. Replicating improved technology at state level has vast potential to raise yield. The yield gaps are much higher in the states which could not benefit from green revolution technology. Supply of good quality and improved seed and extension are the key to reduce yield gap and to raise productivity and production in the country.

National Food Security Mission

National Development Council in its 53rd meeting adopted a resolution to enhance the production of rice, wheat and pulses by 10, 8 and 2mt respectively by 2011-12. Hence, a mission mode centrally sponsored scheme, National Food Security Mission was launched in 2007-08 with an out lay of Rs.4882.48 crores for XI Plan Period.

The Mission aims at increasing production of rice, wheat and pulses through a set of measures such as area expansion, productivity enhancement in selected districts; restoring soil fertility; creating employment opportunities; and enhancing farm level economy to restore the confidence of the farmers of the targeted districts.

The Mission is under implementation in 311 districts of 17 States of the country. The NFSM-Rice is implemented in 136 districts of 14 States, *i.e.,* Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Uttar Pradesh, Tamil Nadu and West Bengal. The NFSM-Wheat is being implemented in 140 districts of 9 States-Bihar, West Bengal, Madhya Pradesh, Punjab, Haryana, Uttar Pradesh, Rajasthan, Maharashtra and Gujarat. The NFSM-Pulses is being implemented in 170 districts in 14 States *i.e.,* Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh, Tamil Nadu and West Bengal.

A close monitoring mechanism through a dedicated team of experts in the form of project management team at district, State and National level is in place. The concurrent evaluation, mid term evaluation and impact analysis has also been planned for effective implementation and mid term correction in the programme for increasing the efficiency.

The expenditure for

implementation of the scheme is 100% funded by the Government of India. Beneficiary farmers need to contribute 50% of cost of the activities / work to be taken up at their / individual farm holdings. Beneficiaries may choose to draw loans from the Banks, in which case subsidy amount prescribed for a particular component for which the loan has been availed will be released to the Banks.

Table5: Frontline Demonstrations yield and actual yield of mustard and soybean *(2003-04 to 2004-05)*

State	Improved practice	Farmer practice	Actual 2004-05	Gap % between I and F	I and A
Mustard					
Bihar	1.38	0.94	0.83	47.0	66.9
Chhattisgarh	1.10	0.77	0.43	42.6	154.9
Haryana	1.64	1.41	1.55	16.3	5.2
Madhya Pradesh	1.96	1.67	1.00	17.4	95.2
Rajasthan	1.66	1.41	1.30	18.0	27.6
Uttar Pradesh	1.54	1.13	1.00	36.7	53.3
Punjab	1.56	1.42	1.19	9.9	30.5
Soybean					
Himachal Pradesh	1.44	1.15	10.00	24.9	44.0
Uttaranchal	1.97	1.49	12.94	31.9	52.5
Madhya Pradesh	1.44	1.13	11.30	27.2	27.6
Chhattisgarh	2.20	1.66	0.84	32.3	161.2
Maharashra	1.90	1.51	13.96	25.9	36.6
Karnataka	1.51	1.30	0.53	16.4	185.1

CHALLENGES, STRATEGY AND POLICY ISSUES

TARGETING THE POTENTIAL AREAS

To maintain the productivity levels of the most productive regions in sustainable manner and to avoid the over exploitation of natural resources, the alternate food grain basket needs to be created. The eastern region comprising of eastern Uttar Pradesh, Bihar, West Bengal, Assam and Orissa are most strategic for rice. The productivity in these States could be increased substantially with improved delivery systems for critical inputs and adequate support to resource poor farmers. The thrust in this region should be on infrastructural development for transport, irrigation, water management and electricity and post harvest management.

Management of climatic changes

The productivity and production of wheat reduced drastically during 2003-04 and 2004-05 due to abrupt rise in temperature during reproductive phase. Concerted efforts are required for strengthening of research for the development of new genotypes having tolerance to heat stress. Policy support for efficient water use during the entire crop period and support for sprinkler and drip system of irrigation is required for sustainable foodgrain production.

Harnessing the Potential of Rainfed Areas

The rainfed areas cover 60% of cropped area and contribute nearly 40% of the total production. Slow growth in rainfed areas is mainly attributed to the low spread of HYVs and inputs like fertilizer leading to low productivity of crops. The productivity in these areas can be increased by conserving soil moisture and selecting crop and varieties having potential for higher productivity under dry land condition.

Efficient Use of Water

Practices like on farm water harvesting and recycling through the creation of farm ponds; in-situ moisture conservation; recharging of ground water; crop planning based on land use suitability; promotion of alternate / composite cropping systems; and use of water saving devices like drip and sprinkler irrigation systems, etc. are need to be promoted for better water management, rainwater harvesting and increasing the water use efficiency. Water saving technologies including varieties need to be developed to economize water use and increase water productivity. Improvement of drainage in eastern Gangetic plains and salt affected soils is important for increasing the productivity.

Diversification for resource conservation

Horticulture development programmes have encouraged agricultural diversification. Diversified cropping systems are required in rainfed areas primarily to reduce the risk of crop failures owing to drought or inadequate rains. The Indo-Gangetic Plains under rice – wheat system offers unique opportunity for diversification through short season oilseeds as catch crop and spring summer pulses like urdbean and mungbean, and summer vegetables in sequential cropping.

Over a large area in the Eastern India, rice is grown under upland rainfed conditions. These upland paddy areas, if diversified, could be more productive with cultivation of maize, oilseeds, pulses, millets, vegetables, horticultural and floriculture crops.

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WTO AGREEMENT ON AGRICULTURE

DOMESTIC POLICY REFORM OPTIONS & THE WAY FORWARD

Akash Taneja[1] and Dr. A.P. Singh[2]

India, among several developing countries had anticipated that with the elimination of huge subsidies by the developed countries, international prices of most agricultural products would rise in the post-WTO phase, which in turn would help traditional low cost producers of agricultural commodities like itself gain more market access for its products. India had expected that cost of production of agricultural commodities of the existing exporting countries would rise once they reduce domestic support and export subsidies in agricultural products. This along with the removal of quotas and other non-tariff barriers and subsequent reduction of tariffs would enable it to increase exports. However, the level of subsidization carried out by the major players of world agricultural trade has not decreased. All available evidence points to the fact that both the US and EU would do nothing in the next few years to bring any measure of discipline on their spending. A careful scrutiny of the statements made by representatives of European Union indicates that no substantial changes from the present position may be forthcoming till at least 2012.

While this may be disappointing for countries like India who expect a number of positive changes in the area of market access and subsidies, the delayed liberalization may have some silver lining. We may utilize this period for two purposes:

(1) Focus on commodities which cover substantial portion of international trade and take measures to make these sectors highly competitive, improving productivity of farm and non-farm operations.

(2) Create commodity-wise detail competitive positioning papers giving country-wise details of productivity, cost of production, tariff details, non-tariff barriers and productivity.

DOMESTIC POLICY REFORM OPTIONS

The policy areas where reform is needed to reinforce India's competitive strengths and help India realize its full agribusiness and agro-industrial potential are:

Public Investment in Agro-Infrastructure including infrastructure for agribusiness: Public investments, at 1999-2000 prices, should be raised annually by 12% during 11th Plan . Hence, considerable public investment will have to be made in irrigation projects, soil and moisture conservation, agricultural research and extension, cold chains, transportation and food processing infrastructure. Public and private investment in rural infrastructure to ease supply constraints would generate significant employment opportunities in rural areas as well.

Improving Farm Productivity: The following steps which can be taken for this purpose include conserving prime farm land for agricultural purposes; preventing unsustainable exploitation of aquifers; developing strategies for strengthening each agro-ecosystem technology development, training, techno-infrastructure and trade; improving food safety standards and sanitary and phytosanitary measures and preventing pesticide residues in food through eco/ organic -farming methods;

enhancing the capacity of small producers to manage risks through crop insurance and farm systems diversification; organizing centralized services to support decentralized production and arresting the declining investment in agriculture by enlisting the participation of the private sector in the areas of infrastructure development, input-supply, contract cultivation and home and external marketing.

Irrigation: Higher efficiency can be achieved by generating synergy among water, variety, nutrients (macro and micro) and farm implements. The concept of maximizing yield and income per unit of water should become internalized in all crop production programmes.

Water quality also needs attention since water often gets polluted at source with fertilizers, pesticide residues and toxic chemicals. Effective management of surface water including rivers, canals, water bodies, lakes, ponds and rainwater can reduce groundwater dependency.

Developing Innovative Farming Methods: Symbiotic contracts which confer benefits to both producers and purchasers will be ideal for ensuring assured and remunerative marketing opportunities. National and international agribusiness enterprises should foster contract cultivation of a wide range of crops, on the basis of assured and remunerative buy-back arrangements. Commercial contracts should take the form of a new social contract with resource poor farm women and men and landless labor families in terms of technology up-gradation, training in new skills and information and knowledge empowerment. If this happens, trade starts assuming a higher purpose than making profit alone. Contract cultivation based on a well-defined Code of Conduct will be helpful to small producers in getting good quality input, a fair price and prompt payment for their produce.

R & D for Agriculture: A much larger proportion of research results including seeds and other scientific inputs are likely to be supplied by the multinationals at exorbitant prices. Complete dependence on multinationals for supply of seeds including genetically modified seeds would become extremely costly and beyond the reach of small farmers. Since this would entail huge costs to the economy, it is important to harness resources for research within the country and to undertake large investment in indigenous Research and Development. R&D for agriculture, including biotechnology, is also critical for the long-term growth and global competitiveness of this sector.

Biological Resources policy

The aim of the policy should be to conserve as well as to enhance biological resources, to provide equitable access and to lead to sustainable use with equitable sharing of benefits. Two major legislations-The Plant Variety Protection and Farmers' Rights Act (PVPFR) and the Biological diversity Act are now in place to achieve the above aims. However, the burden of conservation of animal genetic resources cannot be allowed to fall on the largely impoverished communities which maintain animal genetic diversity. A system of rewards and incentives must be developed to enable and motivate people to conserve their breeds under the Biodiversity Act. The Biodiversity Fund should be used for such purposes. Livestock keepers' inherent rights to continue to use and develop their own breeding stock and breeding practices should be acknowledged. The government must recognize these rights, acknowledge livestock keepers' contribution to the national economy, and adapt its policies and legal frameworks accordingly. This is particularly important to pre-empt attempts to use the intellectual property system to obtain control over animal resources which are an important component of the country's food and livelihood security systems.

There is a need to document the indigenous knowledge of pastoral communities about animal maintenance and breeding. Community-based conservation and development of indigenous livestock breeds and species should be encouraged, with a special focus on both hot and cold arid and semiarid areas where the genetic diversity and associated indigenous knowledge are particularly well developed.

Removal of Barriers to Interstate Trade: It has to be recognized that India being a founder member of the WTO is bound to undertake further economic reforms in agriculture. These would include removal of barriers to both external and internal trade in agricultural commodities through tariff reduction, abolition of internal restrictions to trade, opening future markets, and protecting patent rights etc. India would also need to improve its competitiveness in many agricultural commodities through increase in their productivity and has also to take steps to reverse those policies like continuous hike in administered prices that make its exports non-competitive.

Institutional Reforms: There is a need to undertake some important institutional reforms-consolidation of holdings and gradually freeing the lease market, keeping in mind the interests of existing occupancy tenants. A pro-active policy should be designed to involve the small and marginal farmers and the landless labourers in deriving benefits of increased agricultural exports through innovative institutions like integrated co-operatives such as the mother dairy, and other similar service co-operatives; contract farming, etc. Special efforts should also be made to develop new technologies for the farming sector and connect those to the small farmers for enabling them to diversify their production towards high value commercial and export commodities. The efforts on the production front should be supplemented by creation of institutions like trading houses, market intelligence services and creation of network of information on national and international prices. There is also a need to create necessary infrastructure in processing, marketing and grading of produce.

Domestic Market Reforms:
States must amend the Agricultural Produce Marketing (APMC) Act to allow for contract farming and free marketing, organized retailing, smooth flow of raw materials to agro-processing industries, competitive trading and adoption of innovative marketing system. Also in need of a review is the policy whereby limits on the scale of operation are imposed on the processors of agricultural commodities and manufacturers of farm implements. Internal taxes and fees on raw agricultural commodities, such as purchase tax, mandi (market) tax, and agents' commission also need to be rationalized and a National Market for agricultural produce should be established to ensure legitimate share of the farmer in the final value of the produce.

Crop Diversification: The emerging scenario of increasing diversification offers an opportunity for raising farm incomes significantly as the employment elasticity for these activities is quite high. Private sector engaged in agro-processing and agro-business can promote diversification, both by providing inputs and assured market for output through contract farming.

Input Provisioning
Supply of seed needs urgent attention as quality of seed is the basic determinant of productivity. Seed production and distribution needs revamping by strengthening public sector seed agencies and by involving private trade in seed multiplication and distribution. Quality checks on inputs are becoming important as cases of unscrupulous trade fleecing farmers by selling spurious seeds, fertilizer and chemicals are on the rise. The development, introduction and diffusion of environmentally safe and effective pesticides should also be given priority.
Small farmers need implements for timely sowing, management of weeds and improved post-harvest technology. This need is particularly great in hill areas. Women especially need women-friendly implements / tools which can reduce drudgery, save time and enhance output and can be handled comfortably. Farm graduates can provide tractors and other larger farm implements on a custom-hire basis by organizing Agri-business Centers.

Ensure Uniform Agriculture Policies: In view of the country confronting such issues as standards, environment, trade etc. in the context of the WTO, which are really national issues, the need of the hour is to try to bring subjects like agriculture, forestry and fisheries under concurrent list so that common and uniform policies and strategies can be evolved through a process of negotiations and consultations with the various state governments. By placing agriculture on the Concurrent List, serving farmers and saving farming becomes a joint responsibility of the Centre and States.

Export Promotion Measures
To boost up exports, it is necessary not only to increase exportable surplus, if necessary by supplementing domestic consumption through imports of cheaper varieties of the same product (as, for example, in cases of tea & rice), but also to be selective in the items of exports-specifically, to choose non-primary and value-added items of exports for which the price and income elasticity's of demand are relatively high. Products arising from such versatile crops like sugarcane, paddy, cotton, which allow for elaborate industrial use of bio-mass and can thus not only generate more income and employment opportunities at home, but also offer greater opportunities for absorbing external shocks ought to be given higher priority within our export basket. Measures which could be taken to boost exports of agricultural produce are:

- **Value Addition:** Probably the most important step to boost up the price of Indian exports is to achieve agro-processing and value addition of our agri-

commodities under appropriate farmer-controlled and farmer-managed organizations, as the developed countries like the EU, the US, Canada, Australia and new Zealand have been doing. This will not only increase the shelf life of India's agri-exports, but also augment the bargaining power of her grass-root level producers. Like the developed countries, India has to simultaneously take advantage of bilateral, regional and multilateral trade agreements to boost up the value of her exports and at the same time to source her imports from the cheapest source.

- **Quality and Environmental Standards:** To take appropriate safeguards against possible opportunistic use of SPS and TBT clauses against our agri-exports, the Ministries of Commerce & food Processing must procure sufficient trade intelligence about her potential markets and undertake necessary pre-emptive steps to handle possible quality and environment-related issues that may be raised against Indian products.
- **Organic Farming:** Organic farming requires more scientific support than chemical farming. Internationally accepted certification procedures also need strengthening and must be farmer-friendly and affordable. Organic farming zones could be identified, like some of the hill areas and islands where currently chemical fertilizer use is very low, and for medicinal plants where the use of chemical pesticides and fertilizers is not advisable. Food safety and quality specifications should conform to the Codex Alimentarius standards since there are occasional reports of heavy metals being present in organic foods. Subsidies or loans similar to those given to farmers to buy chemical fertilizers / pesticides should be available for organic manures like farm yard manure, compost and biofertilizers and biopesticides also. Farmers engaged in organic farming should be linked to niche markets where they will obtain a premium price, in order to compensate for any loss in yield. Farm graduates may be supported for establishing agri-clinics and agribusiness centres for organic farming. The market for organic products has been growing at more than 20 per cent annually in the EU and the US.

- **Reliable Database:** For a comprehensive analysis of India's export performance –both product and destination-wise, data reporting system must change in two ways-at the level of both APEDA (Agricultural and Processed Foods Development Authority) and CMIE (Centre for Monitoring Indian Economy) first, both quantity and value figures in dollars ought to be reported. Second, for any meaningful analysis, the performances of rival countries in the major import markets are also to be provided. While APEDA may restrict analysis to the products under its jurisdiction, at least the CMIE must supply comprehensive data on a continuous basis. The formats of the Timely Reporting Scheme (TRS Scheme) as well as the Improvement of Crop Statistics (ICS) Scheme need to be thoroughly reviewed and changed for bringing about a lasting improvement in the basic system of Agriculture Statistics. An alternative methodology for estimation of production of the horticultural crops as recommended by NSC should be followed. The economic contribution of post-harvest activities such as trade, processing, packaging and the related activities in the periphery of agriculture need to be captured as GDP share of agriculture and allied activities.

Improving Agricultural Insurance Coverage

There is scope for improving the coverage of the National Agricultural Insurance Scheme (NAIS) in terms of regions and crops, substitution of long term yield rate as a bench mark and ensuring prompt payment of the indemnities. The decision to devolve the area of damage assessment from blocks to smaller units may be done with care, as the costs of such decentralization and the moral hazards will be very high compared to the likely benefits. All commercial banks, Regional Rural Banks (RRBs) and the Cooperative Banks should make crop insurance mandatory for all agricultural loanees, especially because such insurance can indirectly contribute to the viability of rural banking.

Access to Agricultural Credit

The financial services must reach all its users effectively; the credit

must be in time, in required quantities and at appropriate interest rates. The interest rate should be as low as possible. It should be possible to bring about a reduction in the transaction cost. The inefficiencies of the delivery system should not be loaded on the interest charged. The delivery system has to be proactive and should respond to the financial needs of the clients in rural areas. The banking system needs to explore the large unmet credit potential needed to raise agriculture to higher thresholds, and for the growth of rural and agri-business enterprises and employment. There is a need for an Agriculture Credit Policy. The credit cooperatives have an important position in the rural financial system and priority should be given to the formulation of such a policy.

Marketing Opportunities

The State Governments will have to undertake many reforms speedily in order to provide more options to the farmers for selling their produce, allowing the private sector, including the cooperatives, to develop markets, promote direct sales to consumers and remove bottlenecks and scope for corruption and harassment. What farmers seek is greater protection from market fluctuations. Important steps are needed to strengthen the Minimum Support Price (MSP) mechanism and implement it effectively across the country. MSP of crops needs to keep pace with the rising input costs; the Market Intervention Scheme (MIS) should respond speedily to exigencies especially in the case of sensitive crops in the rain fed areas; establish Community Foodgrain Banks to help in the marketing of underutilized crops and thereby generate an economic stake in the conservation of agro-biodiversity; provide capacity building for farmers who can produce a wide range of health foods and herbal medicines and market them under strict quality control and certification procedures and making the Public Distribution System (PDS) universal, thereby enabling it to undertake the task of enlarging the food security basket by storing and selling nutritious millets and other underutilized crops.

Restructured Land Use Boards supported by a team of technical experts/agencies should render the service of authentic information for land use decisions and investments. Infrastructure support has to be put in place to minimize post-harvest losses and enable agro-processing and value addition at the village level itself to increase jobs and income. The collective strength of farmers has to be built up by encouraging farmers' organizations and other entities like cooperatives and small farmers' estates so that they can get a fair deal and enjoy the economies and power of scale. Constraints in improving the negotiability of warehouse receipts also need to be removed.

There is need for an Indian Trade Organisation (ITO) that will safeguard the interests of the farmer families by establishing a Livelihood Security Box to ensure fair trade. The Livelihood Security Box should have a provision to impose quantitative restrictions on imports and or/increases in import tariffs, under conditions where imports of certain commodities appear to be detrimental to the work and income security of large numbers of farming families. Farmers' Associations and SHGs should be helped to export on competitive terms by spreading awareness of the opportunities available for external agricultural trade. The agri-export zones should be further strengthened and should become places where farmers will get the best possible price for their produce. The future of Indian agriculture will depend upon the efficiency and seriousness with which pro-farmer marketing systems are put in place.

Incentivising Women Farmers and Attracting Youth

Enhancing women's rights in land, providing infrastructure support to women farmers, and advancing legal support on the existing laws, will get recognition for women as farmers and enable them to access credit, inputs, and marketing outlets. Second, women's names should be recorded as cultivators in the revenue records, on family farms, where women operate the land having ownership in the name of male members. The gender bias in the functioning of institutions for information, extension, credit, inputs and marketing should be corrected by gender-sensitizing the existing infrastructure providers. Women's cooperatives and other forms of group effort should be promoted for the dissemination of farm technology as well as for the marketing of produce.

Educated youth should be helped through a form of Venture Capital Fund, low interest loans and allotment of wastelands for setting up agri-clinics and production-cum-processing centers to undertake

outsourcing jobs, both from within and outside the country, enabling India to emerge as a major agricultural outsourcing hub. Eco-agriculture is knowledge intensive and hence there is a need to ensure that large numbers of educated young men and women take to farming and farm related enterprises as their vocation. This is an area where symbiotic partnerships between young entrepreneurs and the private sector will be beneficial.

Encouraging Private Sector Participation in Agriculture

Private sector can play a major role not only in the post-harvest handling and distribution of produce but also by forging appropriate arrangements such as contract farming with farmers, particularly for high value crops.

Taking Proactive measures for Climate Change

Proactive measures to reduce the vulnerability to climate changes have to be developed. Based on computer simulation models, contingency plans and alternative land and water use strategies will have to be developed for each major agro-climatic zone. In drought and flood prone areas, experienced farm women and men can be trained as "Climate Managers", in the art of managing drought, flood and aberrant monsoons.

The way forward

India's demonstrated comparative advantage in tropical products and its emergence as a competitive supplier in many temperate-zone products, places it in a very good position to adopt a bold approach in the negotiations on agriculture. India must do so not only in seeking reduction in support and protection in the developed countries but also in offering concessions itself. The danger in maintaining a defensive posture is that it would tilt the balance in favor of minimal liberalization and the continuation of the flawed framework of the Uruguay Round that several major players are seeking. As an efficient producer of agricultural products in general, it must make all efforts to obtain a fundamental reform of world agriculture. Seeking reduction in support and protection by all countries is a better strategy than pursuing the objective of keeping its own market access restrictions at a high level. India can never compete with the major developed nations in extending domestic support or granting massive subsidies to their agricultural exports. It is true that Indian agriculture could be threatened by the high levels of subsidization prevailing in the developed countries, but the remedy lies in getting them to make a steep reduction in these levels rather than in asking for the ability to raise the already high tariff levels in India. Gradualism has failed miserably in ushering in real reform in world agriculture and what is needed now is the radical reduction of support and protection. Instead of returning after short periods for further rounds of tortuous negotiations the aim should be to chart out the course that must be covered over a longer term.

There has to be a fundamental shift in the approach of India and other fellow developing countries in showing each other respect. They need to emphasize less on special and differential (S&D) treatment and more on equal treatment. There was little value in the developing countries having been allowed in the Uruguay Round to make reductions in tariffs at a lower rate and over a longer period while some industrialized countries retained the possibility of maintaining tariffs in multiples of 100 percent on some key products. The high base rates in the EC and the US that resulted from the tariffication process have exposed the flaws in the arrangement.

Special and differential treatment proved to be a more potent negotiating tool for the developed countries, as it helped them to influence the developing countries to become less demanding on them for undertaking real reforms. The lesson to be learnt from the Uruguay Round is that the developed countries would need to be subjected to much more moral and political pressure in the future before they relent on their highly distorting agricultural policies. One of the ways of doing this is to throw a challenge to them through proposals for deep reform in agriculture, which is at the same time designed to the maximum extent possible, for uniform application to the entire WTO Membership. We believe that if the reform is deep enough it can be applied equally by the developing countries without it becoming burdensome for them.

The key concerns of developing countries i.e. meeting the objectives of food security and livelihoods have to ensure that effective market access is available in the larger markets and that market prices reflect efficiency costs. The need of the hour is that the developing countries should strengthen their negotiating power, as their share in world trade is increasing.

India must realize that with the huge market herein and substantive growth of middle class during past few decades, no developed country can ignore her. Though India currently accounts for less than 1% of the world imports, it promises to be a vast market in the near future. However, agriculture having the elements of livelihood and employment forces, we need to be protective also. Balancing the two opposing factors, our endeavor must be to force continuously our view points and interests during the negotiations on one hand and take the domestic agriculture policy reforms including creating of an agribusiness and agro-industry platform at the home front as a mission to be accomplished to ensure a glorious destiny for the country in the field of agriculture and food security.

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The Changing Face of Agro Finance

Indian agriculture, a potpourri of agro ecological conditions interspersed with equally diverse levels of land holdings has got all the elements of a successful enterprise. The natural resources, the agro climatic conditions supporting a wide variety of crops, skilled manpower and almost two thirds of the one billion people, who derive their livelihood from this huge industry – all point to the makings of a highly successful industry. These facts might appear to be misleading if juxtaposed against the contribution of Indian agriculture to the Indian GDP.

Though this poor display of economic strength by the agriculture sector has been attributed to the archaic agriculture practices followed fervently by the majority of Indian farmers coupled with fragmented landholdings and severe disconnect between lab and land, the root of all causes is the disproportionate distribution of credit. As agriculture is the soul of rural India, this disparity is reflected in the general well being of the rural populace. The poorest groups spend the highest proportion of their income on food – typically more than 60% and sometimes as much as 90%. Under these circumstances, any drop in earnings, or any additional expenditure has immediate consequences for family welfare – unless savings or loans can be accessed. Financial transactions are therefore an integral part of the livelihood system of the poor.

The changing face of agriculture needs a fresh infusion of credit

Agriculture, which was once practised at subsistence level, has now scaled newer heights. The miniature affair has been transformed into a large scale enterprise with many corporates entering the agri marketing and retail business. Although this has created opportunities for the production of better produce, this development is not that far fetched and unevenly distributed. Along with this pace, the subsidiary industries have not made an equally impressive performance. To support this industry, roads, cold chain, warehouses, packaging and processing units, logistics, trading along with many other components need to be strengthened, the scale of which can only be raised by consistent investment in this field. But over the years, the investments have declined in this sector especially from the public front. Public sector investments did not grow over the years and consequently growth in the stock of public sector capital formation has declined from 3.86 to 1.92% (2007). Agriculture in India is still underdeveloped with respect of production, marketing, processing and transport at the global level. Due to this, agricultural trade after 1996/7 declined at the rate of 1.69% annually. Post-harvest in handling, transport, processing and ports have remained poor. There is a need to increase the supply of institutional credit, through cooperatives, commercial banks and micro finance institutions on easy terms and conditions at low reasonable interest rate. "The changing economic landscape of agriculture and growth opportunities are also reasons for focusing on private sector investment in agriculture; Though there has been stagnation of sorts in the sector –agro- processing offers scope for tremendous growth, with hardly about 7% of farm produce now processed. Compared to developing countries like USA, for example, almost 60-70% of the fruits produced are processed", says Mr A.C. Mahajan, Chairman and Managing Director, Canara Bank. Initiatives are required to accelerate Insurance against risks in agriculture of all crops at every season.

The eleventh five year plan has addressed all these issues and 11th Plan comes to 2.25 times more than the outlay of 10th Plan. The Eleventh

Plan aims to bring 11 million ha of land of new irrigation potential and another 3-4 million ha of land from modernization of existing structures and restoration of tanks. It has estimated a total financial requirement of Rs.2,08,000 crores for irrigation, command area development and flood control.

Biotechnology, another important area has also been fairly addressed in the eleventh five year plan and an amount of Rs.12000 crores have been outlined for the overall development of this field. Similarly, fertilizers, a cardinal input in the Indian agriculture also has been the focal point of the policy makers and is accustomed to receive huge chunks of favour as subsidies. Though the fertilizer industry is core to the existence of Indian agriculture, there has been a considerably minimal fresh investment in this industry. The subsidy generously doled out by the government has earned the wrath of the fertilizer industry. "The cash strapped fertiliser industry needs reimbursement of major portion of its delivered cost, which is paid in the form of subsidy, in cash only to meet its day-to-day payment obligation for purchase of feedstock/ raw materials.

The subsidy constitutes more than 80% of the delivered cost of fertilisers. No industry can sustain operations if such a large portion of its cost remains blocked with the Government. As the subsidy burden of the Government has reached an un-sustainable level, the industry expects some bold and effective steps by the Government to resolve the situation", says R C Gupta, Deputy Director General, Fertilizer Association of India.

Food Processing Industries considered as the sun rise Industry has suddenly emerged as a prominent player and is being provided assistance for setting up/ expansion/ modernization of food processing industries covering all segments including milk products, meat, poultry, fisheries, oil seeds and other such agri-horticultural sectors. The Eleventh Five Year Plan for this industry has been set at Rs.5006 Crores.

Rural Finance is the backbone of the Indian Agriculture

Rural finance is inclusive of the financial services offered and used in rural areas by farm and non-farm population of all income levels trough a variety of formal, informal and semiformal institutional arrangements and diverse type of products and services, such as loans, deposits, insurance, and remittances. Agri finance is a crucial subset of rural finance.

Till date the informal sources remains the largest benefactor of the rural credit needs. Money lenders although charge exorbitant rates, still remain the most preferred source of credit. The hassle free transactions and easy access make the farmers indebted to them paying a huge price.

The institutionalization of credit in the rural areas has to some extent been successful in wiping out the sole dependency of farmers on private money lenders. Agricultural credit is disbursed through a multi-agency network consisting of Commercial Banks (CBs), Regional Rural Banks (RRBs) and Cooperatives. There are approximately 100,000 village-level Primary Agricultural Credit Societies (PACS), 368 District Central Cooperative Banks (DCCBs) with 12,858 branches and 30 State Cooperative Banks (SCBs) with 953 branches providing primarily short and medium-term agricultural credit in India. The long-term cooperative structure consists of 19 State Cooperative Agricultural and Rural Development Banks (SCARDBs), with 2609 operational units as on 31 March 2005 comprising 788 branches and 772 Primary Agricultural and Rural Development Banks (PA&RDBs) with 1049 branches.

The institutional credit has strengthened the rural financial sector. Every year specific targets are laid by the union government and to some extent has been successful in maintaining their tempo in rural financial sector.

Recently, the rural geography has been found to be interspersed with services offered by many commercial banks. "72 % of India's population lives in rural areas. Ours is basically rural centric and agrarian economy. About 65-70% of the population is dependent on agriculture. Agriculture and Allied sectors contribute nearly 22% of GDP of India. The Banks were nationalized with a social objective of reaching out to the common people. Banking facilities and services have been made available to the people in rural and remote areas like North East Region. Credit flow to Priority Sector, Agriculture, Weaker Sections and Implementation of various Credit Programmes immensely help for economic empowerment of rural

masses. The SHG movement has taken deep roots in the rural areas. Farmers and rural masses are genuine and honest in utilizing the farm credit and repaying the loans promptly. The rural banking is a viable business proposition for the Bankers.

There is a lot of untapped banking potential in rural areas. There are 31,117 rural and 18,096 semi-urban branches of scheduled commercial banks as of Sep' 2008 in the country as a whole. These branches constitute 64% of the total 77,069 bank branches in the country but account for 23% of the total deposits and 16% of the total advances. The Invest India Market Solution (IIMS) Survey indicates that only 14% of agricultural wage labourers have bank accounts. There is vast scope for agriculture and rural development through Financial Inclusion. Hence, rural banking is one of the important building blocks of our nation's economy," explains M.S. Sundara Rajan, Chairman & Managing Director, Indian Bank.

This year the budget has also kept the slogan of '*aam admi*' in mind while allocating funds in the budget proposals

The Government of India has over the time has accorded special packages in the budgets. "Agriculture is a state subject and there is a limit to what the Central government can do to help in accelerating the pace of progress in improving the productivity and profitability of small holdings. Nevertheless, the government of India can show the way by providing incentives for right action. During the last three years, several major steps have been taken to reverse the trend of lack of investment in rural areas. Apart from Bharat Nirman, schemes like Rashtriya Krishi Vikas Yojana (Rs 25,000 crores), National Horticulture Mission (Rs 20,000 crores), National Food Security Mission (Rs 5,000 crores) have been introduced", says the renowned agriculturist M.S. Swaminathan.

The agriculture sector has recorded a growth of about 4 per cent per annum.

In 2008-09, agriculture credit flow was Rs.2,87,000 crores. In the union budget 2009-10, the target for agriculture credit flow for the year 2009-10 is being set at Rs.3,25,000 crore. The Finance Minister, Pranab Mukherjee in his budget speech outlined the measures to achieve this. "To achieve this, I propose to continue the interest subvention scheme for short term crop loans to farmers for loans upto Rs.3 lakh per farmer at the interest rate of 7% per annum. I am also happy to announce that, for this year, the Government shall pay an additional subvention of 1% as an incentive to those farmers who repay their short term crop loans on schedule. Thus, the interest rate for these farmers will come down to 6% per annum. For this, I am making an additional Budget provision of Rs.411 crore over Interim BE."

The Rs.71,000 crore one-time bank loan waiver was one of the highlights of the previous budget. Although this budget did not propose any such populist measure, an extension to the payment of the overdues was extended up to 31st December, 2009 instead of the 30th June, 2009 under the Agricultural Debt Waiver and Debt Relief Scheme (2008).

An additional Rs.1,000 crore over Interim BE has also been earmarked for the Accelerated Irrigation Benefit Programme (AIBP), marking an increase of 75% over the allocation in 2008-09(BE). The allocation for the Rashtriya Krishi Vikas Yojna (RKVY) is also being stepped up by 30 per cent over Budget Estimates of 2008-09.

Apart from agriculture, enough financial support is also being pumped for uplifting the rural populace. NREGS was apportioned Rs.39,100 crore for the year 2009-10, an increase of 144% over 2008-09 Budget Estimates. Another highly anticipated programme, National Food Security Act which aims at every family living below the poverty line in rural or urban areas who will be entitled by law to 25 kilos of rice or wheat per month at Rs.3 a kilo.

Allocation has also been stepped up for projects such as Bharat Nirman, Pradhan Mantri Gram Sadak Yojana (PMGSY), Rajiv Gandhi Grameen Viduytikaran Yojana (RGGVY) and Indira Awaas Yojana (IAY). Apart from stepping up the amount allocated to the already existing schemes, a new scheme called Pradhan Mantri Adarsh Gram Yojana (PMAGY) is being launched this year on a pilot basis, for the integrated development of 1000 villages and

for which Rs.100 crores is allocated. Similarly, Swarna Jayanti Gram Swarozgar Yojna (SGSY) is being restructured as the National Rural Livelihood Mission to make it universal in application, focused in approach and time bound for poverty eradication by 2014-15.

This year's budget has won admiration from many stakeholders. But they are also equally apprehensive about the rightful implementation of the various schemes proposed. "The Union Budget for 2009-10 has been geared towards creating more demand by an expenditure friendly policy towards welfare and rural employment schemes such as NREGA, which is getting a whopping increase of 144% to spend Rs.39,100 crores. Implementation of this mega program, and reaching the right people will remain a major challenge, and only time will tell whether such expenditure will have any positive effect on the poor. In the meantime, highest ever fiscal deficit will be created since the economic reforms started in 1991, which will start putting inflationary pressures not too distant in the future. Growth oriented schemes for agriculture are somewhat less. The only commendable scheme is that of Pradhan Mantri's grameen sadak yojana (rural roads). IFPRI's research shows that rural roads have maximum impact in alleviating rural poverty. The FM could have done much better by raising allocations for agriculture R&D, for irrigation investments, cleaning several policy hurdles to encourage private sector participation in agri-business, especially in the seeds sector, in agro-processing, and in retailing. None of the expected reform agenda has been announced, and therefore, no wonder, there has been a very dampened response from the markets", says Ashok Gulati,

Director in Asia, International Food policy Research Institute.

Rural banking and credit is going to assume more significance in the future.

The banking sector has recognized the true potential of the rural banking and credit. Even the future is not going to be different asserts Dr.K. C. Chakrabarty, Dy. Governor, RBI. "Going ahead, rural banking and credit would gain in significance. The wide fluctuations in global agro prices in recent years have once again underlined the importance of self-sufficiency in food production. Further, if the Indian economy is to grow at 10% over the next few years, it would not be possible unless the agriculture sector grows at 3-4% pa. A stronger agriculture and rural sector would have a multiplier effect in the economy by generating demand for goods and services.

The underpenetrated and under-serviced rural sector offers vast business opportunities for rural banking and credit. Expansion of banking services in the rural areas would help in maintaining the growth momentum of the banking sector despite slowing down of the economy. The prosperity of the rural areas in turn would help the banks to prosper and hence it is in their own vested interest that the banks would need to work towards the development and prosperity of the rural areas. Replacing the private credit is a big challenge as well as opportunity for the banking sector.

Recognizing the emerging significance of the rural sector, even the private banks which hitherto were restricted to urban centres are entering the rural areas. The MFIs, NBFCs are also making inroads into the rural areas in a big way. Banks can maximize their reach to the rural population through these MFIs / NBFCs.

To reduce the intermediation cost, multipronged arms would be used to reach the rural masses. Besides, network of branches, adopting BC/BF model, technology innovation like rural kiosk etc would have to be employed. PNB is contemplating One Lakh such touch points in the rural areas within the next five years.

Going ahead, rural credit will get a boost on account of the recent initiatives of the Govt. to issue Unique Identity Number to all the Citizens of the Country which will facilitate compliance of KYC norms and hence simplify the process of purveying rural credit".

Agriculture, all over the world is under severe stress. The situation is also not so different in a country like India. In India, a country where agriculture assumes profound influence owing to the heavy dependency of the majority of the population, the situation is worse. With a population of 1 billion who spend 50% on food and with a rapid increase in the upper and middle class population, there is going to be a tremendous gap in food production that needs to be addressed as soon as possible. Only with fresh investments from various sources can we address these issues. Even the policy environment should be made favourable to invite investments in to this sector.

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Research, Training, Extension and Education

MARKETING, VALUE ADDITION AND EXPORT OF HORTICULTURE AND PROCESSED PRODUCTS– PROBLEMS AND PROSPECTS

Dr.T.M.Gajanana & Dr.M.R.Hegde

The importance of horticultural crops, especially fruits and vegetables, in improving the nutritional status and economy needs no emphasis. The varied agro-climatic conditions prevailing in India are conducive for the cultivation of fruits and vegetables in different stages round the year. The importance of this sector has been realized by the planners and policy makers only recently. Establishment of National Horticulture Board (NHB) in 1984, creation of APEDA in 1986 for encouraging exports, formation of a separate Ministry of Food Processing (MFPI) in 1988 for improving processing of horticultural crops and adoption of liberalized seed import policy in 1988 to overcome the constraints of non-availability of quality planting material are some of the important steps taken by the Government of India for encouraging the horticulture sector. The major boost to horticultural development was given during VIII plan by an allocation of Rs.10,000 millions which coincided with the liberalization policies initiated by the GOI. A special provision of Rs.975 millions was also made for export of horticultural crops. During the liberalization period many policies were initiated for the overall development of horticultural sector. The important ones are: according 100 per cent EOU status to floriculture, 'Extreme Focus Area' for fruit and vegetable processing industries and floriculture, abolition of excise duty on processed food, subsidy on export of fruit, vegetables and flowers by APEDA etc. It is heartening to note that in order to improve the level of processing to reduce wastage, increase marketability and to help the farmers to enjoy higher value realization, APEDA has developed a concept of Agri-Export Zones (AEZ). It takes a comprehensive look at a particular produce/ product located in a contiguous area for the purpose of developing and sourcing raw materials, their processing/ packaging leading to final exports. Thus, cluster approach is followed to address marketing problems of certain produce/products in a specified area. In fact, there are 60 AEZ for horticultural produce/products. The plan allocation has further increased to Rs.12,000 millions during IX plan and to Rs.17,000 millions during the X plan. Further, under National Horticulture Mission (NHM) also horticulture is being supported by the government.

The steps taken and policies initiated by the GOI have started giving results in terms of increased production. The introduction of hybrids in case of vegetables like tomato, cabbage, cauliflower, chillies etc. during the late eighties has increased the productivity. However, concurrent improvements are not made in production and marketing of fruits and vegetables which has resulted in gluts in the market and violent fluctuations in prices.

Against this background, the article analyses in detail the present status and trend in fruit, vegetable and flower production, marketing and export scenario in the context of changed policy environment and strategies for improved production and post harvest handling of fruit and vegetables.

Horticultural scenario in India

Horticulture sector including plantation and spices crops has

Fig.1: Horticulture scenario in India

been growing over the years. Horticulture comprising fruits, vegetable and flower crops constitute the major chunk of this sector accounting for more than 90 per cent. Further, the share of these has also been increasing over the years [Fig. 1].

A.FRUITS AND VEGETABLES

I. Production of fruits and vegetables

With the GOI initiatives having started bearing fruits, India is now the second largest producer of fruit and vegetables contributing about 10.90 per cent and 11.90 per cent to the total world fruit and vegetable production, respectively. Among fruits, India ranks first in the production of mangoes (40%), banana (24.5%), papaya (28.8%) and lime and lemons (11.9%). Among vegetables, India is the largest producer of peas (29.5%); second largest in brinjal (28.7%), cauliflower (28.9%), onion (14.7%) and cabbage (8.8%). India ranks fourth (7.3 %) in tomato production.

Fruit and vegetable production in India (in 000 tonnes)

Year	Fruits	Vegetables	Total
1993-94	32947.33	62708.33	95655.66
1999-2000	44266.67	83680.67	127947.34
2006-07	56176.17	108776.20	164952.40
CGR (%)	3.62	4.16	3.97

Productivity of fruits and vegetables

One of the disquieting features of the Indian horticulture sector is the low and declining productivity of fruits and vegetables. Among fruits, the average productivity is much lower in India compared to other fruit producing countries in the world. Except grapes and banana, the productivity in India is much below that of the other fruit producing countries.

As regards vegetables, the average productivity is the lowest in India and among individual vegetables also, the productivity in India is the lowest among the major vegetable producing countries in the world.

Productivity of Fruits - India vis-à-vis other countries (t/ha)

Fruits	Countries					
	India	China	Brazil	USA	Italy	Philippines
Major fruits	10.70	8.50	15.50	23.20	14.90	12.20
Banana	33.10	24.40	13.60	-	-	15.10
Grapes	25.40	14.50	-	18.70	11.30	-
Mango	6.20	8.50	16.00	-	-	5.80
Papaya	31.70	-	48.30	-	-	15.50
Pineapple	15.80	19.00	37.10	-	-	36.30

Source: NHB, 2007. Indian Horticulture Data Base 2006

Productivity of Vegetables - India vis-à-vis other countries (t/ha)

Vegetables	Countries				
	India	China	Brazil	USA	Italy
Major vegetables	15.20	19.30	-	28.20	27.00
Brinjal	16.50	17.90	-	-	-
Cabbage	22.10	19.70	-	36.90	-
Cauliflower	18.00	20.30	-	18.60	23.70
Onion	13.30	21.10	19.50	51.20	-
Peas	7.30	9.20	-	10.00	-
Tomato	17.50	24.20	57.00	66.30	51.80

Source: NHB, 2007. Indian Horticulture Data Base 2006

Growth in production of fruits and vegetables

In India, fruits are grown on an area of 5.51 million hectares with a production of 58.92 million tonnes. The important fruits are mango, citrus, banana, apple, litchi, guava, pomegranate and sapota. Vegetables are grown on an area of 7.49 million hectares with a production of 116.33 million tonnes. The important vegetables grown are potato, brinjal, tomato, onion, okra, cauliflower, cabbage and green peas. Production of fruits and vegetables has increased from about 87.13 million tonnes in 1991-92 to about 174.95 million tonnes in 2006-07 [NHB, 2008].

Fruits and vegetables together

registered a growth of 3.97 per cent in production, 3.06 per cent in area and a meager 0.89 per cent in productivity. As regards fruits, production registered a growth 3.62 per cent which was mostly area led (4%) rather than productivity led (-0.37%). In case of vegetables, production grew at 4.16 per cent and here also area led growth was noticed as the area grew at a rate of 2.44 per cent and yield registered a growth of only 1.68 per cent.

II. Marketing of fruits and vegetables

Post harvest loss and its impact on per capita availability

Despite a phenomenal increase in the production of fruits and vegetables, the much needed nutritional status of the population has not improved much as the per capita availability of fruits and vegetables is still about 87.55 g/day for fruits and 174 g/day for vegetables which is far less than the recommended levels of 120 g/day and 300 g/day, respectively, for fruits and vegetables. One of the main reasons for low per capita availability is the enormous losses of fruits and vegetables which are estimated to be 17 to 35 per cent that occur at different stages of handling, transport, storage, processing and distribution. The post harvest losses in fruits and vegetables also result in increase in the transport cost and hence the marketing cost.

Thus, the post-harvest losses in fruits and vegetables affect both producers (by reducing their share in the price paid by the consumer) and the consumers (by reducing the availability of fruits and vegetables and also through higher prices paid because of the increase in the transport cost etc,.). Besides, at the macro level, the economy would be losing crores of rupees due to total cost of the losses of fruits and vegetables. India annually loses fruits worth Rs.14685 crores (25% loss at an average price of Rs.10,000/t) and vegetables worth Rs.8724 crores (a loss of about 20% at an average price of Rs.4000/t.). Together, losses in fruits and vegetables amount to Rs.23409 crores.

Present marketing system for fruits and vegetables

Due to the presence of too many intermediaries and concentration of trade in a few hands resulting in exploitation of the grower – sellers, the producer's share in consumer rupee is low. However, in view of the increased production of fruits and vegetables and also to sustain the interest of the cultivators and also to motivate them to produce more, it is imperative that they get a reasonably high price for their produce. It is also essential to identify the best channel of marketing which ensures this. In this context, the present marketing system is examined.

Fruit marketing

Pre-harvest contractors (PHC) are found to be predominant in marketing of fruits as nearly 75 per cent of fruits has been marketed through PHCs. The recent studies on mango, pomegranate, banana, grapes and pineapple also reported the dominance of PHCs in marketing. Thus, it suggests that the predominance of PHCs in fruit marketing is still continuing despite the fact that it is not a desirable practice.

Marketing of vegetables

The studies on vegetables have shown the predominance of commission agents (CA) in their marketing. The analysis of costs and returns associated with this channel indicated that commission charges account for the major component of marketing costs followed by transport cost.

Marketing strategies

Transformation is taking place in marketing of high value commodities like fruits and vegetables due to globalization and liberalisation. Accordingly procurement and distribution system for fruits and vegetables is also witnessing institutional innovations in the form of contract farming, growers' associations, cooperative marketing and also integration of production and marketing through processing. Of late super markets (Retail Supply Chain) are entering the fruit and vegetable marketing in a big way. While on one hand these transformations are creating opportunities to the farmers in terms of increased access to markets, quality inputs, technology, information and services which eventually lead to improvement in productivity and reduction in marketing and transaction costs [Birthal *et al*, 2007]. On the other hand, there is apprehension as to whether these innovations would benefit the small holders. Studies conducted at IIHR,

Bangalore [Gajanana, *et al*, 2003; Subrahmanyam, 2000; Subrahmanyam and Gajanana, 2000; Sudha and Gajanana, 2003] have brought out the beneficial role played by cooperative marketing of fruit and vegetables, growers' associations, distant market sale, integrating production with marketing through processing and contract farming.

III. Export of fruits and vegetables

Globalization is creating opportunities for the export of high value commodities like fruits and vegetables. Though India is not a prominent player in the international market for fruits and vegetables, the export sector for fruits and vegetables has been looking brighter especially during the last decade. Between 1993-94 and 2004-05, the export of fresh fruits and vegetables has registered a significant compound growth (CGR) of around 13.98 per cent in value and 9.94 per cent in quantity. On the other hand, processed fruits and vegetables registered a CGR of 15.72 per cent in value and 14.39 per cent in quantity during the same period thereby suggesting the prospects for both fresh and processed fruits and vegetable. Further, the prospects appear to be better for the latter in the international markets. Mango, grapes, pomegranate, onion, tomato and gherkins are the important fresh fruit and vegetables exported. During 1993-94 to 2004-05, fresh grapes registered significant CGR of 10.37 per cent in value and 4.29 per cent in quantity. UK, Netherlands, Sri Lanka and UAE are the major importers of fresh grapes from India. Export of fresh mango has been growing at a rate of 8.57 in quantity and 8.84 in value. UAE, Bangladesh, Kuwait, UK and France are the major importers of mango. Pomegranate is emerging as an important export oriented fruit and its export is growing at 10.04 per cent in quantity and 15.81 per cent in value both of which are higher compared to the growth registered in mango and grapes. Export of all fruits together has registered a growth of 8 per cent in quantity and 10 per cent in value. Export of vegetables is growing at 8.59 per cent in quantity and 14.14 per cent in value. Among vegetables, onion export is growing at a rate of 7.34 in quantity and 11.09 per cent in value.

Processed F&V products exported	Share in total processed F&V products (%)		Growth rate (%)	
	Qty.	Value	Qty.	Value
Dried and preserved vegetables	60.17	52.35	18.77	21.43
Mango pulp	15.16	20.57	13.70	19.98
Pickles and chutney	11.20	8.24	15.93	16.64
Other processed F&V	13.46	18.84	10.39	13.96
Total processed F&V products	24.97*	43.58*	16.03	19.04

Share in total F&V export, Data source: APEDA Export statistics

IV. PROCESSING OF FRUITS AND VEGETABLES AND VALUE ADDITION

Present status and potential

Fruits and vegetables are the major horticultural products, which amount to 58.74 and 109.05 million tonnes respectively. With the cultivated area of about 12.67 million ha. under fruit and vegetables and production of 167.79 million tonnes in 2005-06, horticulture accounts for 7 per cent of the gross cropped area and about 20 per cent of the agricultural output of the country. Share of horticulture to Agricultural GDP is 24.5 per cent. Horticultural products account for 10 per cent of the total agri-exports and more than 19 per cent of the labour force. It is being planned to increase the horticultural production to 350 million tonnes in the near future.

Growth of fruit and vegetable processing industry

The number of processing units

Year	No.of Units	Installed Capacity ('000 t)	Actual Production ('000 t)	Capacity Utilisation (%)
1991	3925	894	280	31.32
1992	4075	950	360	37.89
1993	4132	1108	469	42.33
1994	4270	1260	559	44.37
1995	4368	1402	676	48.22
1996	4674	1760	850	48.3
1997	4932	1910	960	50.26
1998	5112	2040	910	44.61
1999	5198	2008	940	46.81
2000	5293	2100	980	46.67
2001	-	2110	990	46.92
CAGR (%)	3.68*	10.04*	13.29*	2.95*

Significant at 1 per cent probability

and the installed capacity are increasing at a compound growth rate (CGR) of 3.68 per cent and 10.04 per cent per annum respectively. However, the actual capacity utilisation is only 47 percent.

Among the components of processed fruit and vegetable products basket, dried and preserved vegetables accounts for the highest at 60 per cent followed by mango pulp (15%), pickles and chutney (11%) and other processed fruit and vegetables (13%).

Export performance of processed fruits and vegetables

The analysis of data for export performance of processed fruits and vegetables indicated that between 1993-94 and 2004-05, the total processed fruits and vegetables, consisting of dried and preserved vegetables (60%), mango pulp (15%), pickle and chutney (11%) and other processed fruits and vegetables (13%) grew at a rate of 16.03 per cent in quantity and 19.04 per cent in value. The export earnings from processed fruits and vegetables increased from Rs.268.48 crore in 1993-94 to 1463 crore in 2004-05 and its contribution to total fruit and vegetables export has increased from 20 per cent to 25 per cent in quantity and 41 per cent to 44 per cent in value thereby indicating a shift towards processed products. Dried and preserved vegetables registered a significant growth of 18.77 per cent and 21.43 per cent. Mango pulp grew at 13.7 per cent and 19.98 per cent. While pickle and chutney has grown at a rate of 15.93 per cent and 16.64 per cent, other processed fruit and vegetables registered significant growth of 10.39 per cent and 13.96 per cent in quantity and value respectively. Besides, processed grapes, guava products, onion products and tamarind products have shown good progress in the international markets.

All these indicate that export prospects are bright for processed fruits and vegetables products in the international market.

B. FLOWERS

Flowers occupy an important place in Indian society, often symbolic of beauty, love and tranquility. Traditionally, flowers have been used for worship and have special status symbolizing auspicious omen, there by becoming indispensable in all festive occasions, marriages, religious ceremonies and social functions. One of the traditional and most common uses of flowers like jasmine and crossandra is to adorn the hair do of women, mainly due to their aesthetic value. Besides this, flowers appeared to have been recognized for their economic value as well, both as high value crops and through value addition in processing as Indian heritage in perfumery goes far beyond the ancient civilizations. Use of flowers for vase purposes, arranging in bouquets and for gift purposes is commonly referred to as the 'non-traditional use', which is of recent origin under Indian conditions. Increasing modernization and urbanization in India has enhanced the 'non-traditional use' of flowers and has accorded an industry status to flower cultivation in the peri-urban areas and their cultivation under polyhouse conditions popular as 'Hi-tech Floriculture'.

Although the cultivation of modern flowers like hi-tech roses, gerberas, carnation, gladiolus, orchids and anthuriums have better income and employment prospects, the capital intensive nature of their cultivation and the presence of a number of uneconomical farm holding size farms, have in fact preserved the cultivation of traditional flowers under open field conditions, such as cultivation of rose, chrysanthemum, marigold, crossandra, aster and tuberose, especially for domestic markets.

Status of floriculture in India

Any effort at analyzing the status of floriculture in India would get restricted due to the scarce and often unreliable nature of statistical information about this sector. As per the most recent figures available (2006-07), the area under floricultural crops has increased to 145600 hectares with a production of 7.78 lakh tonnes of loose flowers and 3650 million number of cut flowers/ spikes against the less than 31,000 ha and 1.48 tonnes of loose flowers and 22 lakh cut flowers during early nineties. Area under flowers has been growing at a rate of 6.33 per cent per annum. Production of loose flowers registered a growth of very high magnitude of 9.21 per cent in case of loose flowers and 25.33 per cent in case of cut flowers. Tamil Nadu ranks first in area accounting for 18 per cent of the total flower area, followed by Karnataka (15%), Andhra Pradesh (15%), West Bengal (13%) and Maharashtra (10%). Thus, these five states together form the flower

growing belt accounting for about 71per cent of the total area under flowers.

Export of flowers

With the changed policy environment, export oriented floriculture is gaining momentum and the export of floriculture products has increased from a mere 15 crore in 1991-92 to about 653 crore in 2006-07. It may be noted that the domestic flower trade works out to over Rs.500 crore, which is indicative of the relative significance of traditional flowers for the Indian economy, despite the growing market for the modern flowers. It may also be noted that there has been a significant increase in the earnings from export of dried flowers which suggests the growing awareness about the high demand and low cost dried flower industry in India.

C. MAJOR CONSTRAINTS IN HORTICULTURE SECTOR

Horticulture sector, despite doing well, faces a number of constraints which come in the way of its development. The following are some of them.

Production related constraints

- Low productivity of horticulture crops – The productivity of fruit and vegetables has been growing at a very meager 0.14 per cent and in case of fruits, the growth has been negative during the last decade.
- Inadequate supply of quality planting material
- Several unresolved chronic disorders – malformation, spongy tissue, irregular bearing in mango, citrus die back, guava wilt, papaya ring spot virus, bud necrosis in watermelon, bacterial wilt and blight in pomegranate, bacterial wilt and leaf curl virus (TLCV) in tomato
- Losses in the produce due to several biotic and abiotic stresses

Marketing related constraints

- Post harvest losses up to 25 per cent due to improper post harvest handling, lack of post harvest infrastructure like pre-cooling units, packing units, cold storages and processing units
- Wide price fluctuations
- Less than two per cent of the fruits and vegetables is processed.
- Capacity utilization in the existing processing units is less than 50 per cent
- Lack of availability of suitable processing varieties

Export related constraints

- Less quantity (30-40%) of the produce is suitable for export
- Only a few varieties are suitable for export (Mango, Grapes, Pomegranate and Onion)
- Less than one per cent of the fruit and vegetables produced in the country is exported
- Inadequate infrastructure facilities like good road, pre-cooling and cold storage facilities, packing and processing units,
- Non-tariff barriers to trade like SPS, EuRep Gap certification, VHT and irradiation (mango) in case of Japan and USA
- High air freight and need for development of protocols for long distance sea shipment.
- Lack of proper training facility on MRL, production, marketing and export aspects
- Import duty on Indian flowers by EU.

D. R&D INITIATIVES TO OVERCOME THE CONSTRAINTS

Realising the importance of research to overcome some of the pertinent problems, several research institutes have been established. Research institutes like Indian Institute of Horticultural Research (IIHR), Bangalore; IIVR, Varanasi; CPRI, Shimla; NRC on Banana, Trichy; NRC on Grapes, Pune; NRC on Orchids, Pekiyong; NRC on Onion and Garlic; Gururajnagar; NRC on Pomegranate, Solapur; NRC on Medicinal and Aromatic Plants, Anand and CIPHET, Ludhiana have been entrusted with the responsibility of conducting research and come out with solutions to the problems. Some of the technologies developed by the Institutes have been useful in this direction. Role played by IIHR, Bangalore in the development of horticultural sector was brought out in Murti and Gajanana (2008).

E. FUTURE PROSPECTS

The horticultural sector has been doing well over the years. In order to achieve the targeted growth of 4 per cent in agriculture, it is crucial that horticulture sector performs well. On the production front though growth has been achieved much remains to be done and higher growth is envisaged. On the marketing front, the situation is not at all encouraging and the innovations brought out of late have to reach the majority at the earliest. Export, though looks brighter, the proportion of horticulture production reaching the international market has been quite negligible. The fruit and vegetable processing industry has been faced with the problems of quality raw material, capacity utilization, transfer of technology being difficult due to majority of the units being in cottage and home scale sector. Further, less than two per cent of the total production of fruits and vegetables is being processed. The technologies developed by research institutes would help overcome the constraints in the horticulture sector. The recent innovations, if properly utilized, would help overcome the problems of marketing. Further, demand for high value crops like fruits and vegetables has been increasing and the market – both domestic and export – is expanding. Consumption habits and life styles are changing with increased incomes and the market should respond to these changes. The farmers should take advantage of these changes and contribute, in turn, for the development of the horticultural sector.

IIHR , Bangalore

GROW BIOFUEL IN A SUSTAINABLE, ECONOMICAL AND ECOFRIENDLY MANNER

Dr TP Singh[1], Dr Mohar Singh[2] and Dr SK Sharma[3]

Biofuel has the potential to increase energy security, create new economic opportunities in rural areas, reduce local pollution and emission of greenhouse gases. The sector also generates a significant number of jobs. The ethanol industry is credited with providing more than 200,000 jobs in the US and 500,000 jobs in Brazil.

Energy security has been a huge challenge for India, which has 17 per cent of world's population but less than 1 per cent of known oil and natural gas resources. We still import nearly 78 per cnet of the crude we need. Then there are environmental issues. Oil is a fossil fuel (found underground) and burning of any fossil fuels adds to pollution. So we need biofuel-greener alternatives, fuel grown above ground. We also need to better leverage the usage of electricity. Railways are in the best position to do so, while a fillip to hybrid cars can help.

Out of 55 million ha of wasteland available in the country, wasteland available for Jatropha cultivation under National Mission on Bio-diesel for Jatropha Plantation has been estimated at 40 million ha which is almost 73.51 per cent of the total wasteland availability of the country. Among the tree born oil seeds the trees that enjoy maximum prominence for biodiesel production in India include Jatropha curcas and Pongamia. The states that have seriously taken up Jatropha cultivation in the country include-Orissa, Uttar Pradesh, Chhattisgarh, Rajasthan, Madhya Pradesh, Uttarakhand, Tamil Nadu, Gujarat, Jharkhand and North eastern states. The government has decided to use non-edible oil from *Jatropha curcas* seeds as bio-diesel feedstock. Bio-diesel can act as a defensive tool for India against energy security and climate change; and at the same time help in contributing to rural development. But this potentiality has not yet been fully explored particularly due to lack of proper policy directives, absence of a central board and a monitoring agency on Bio-fuel. In spite of the tremendous potential in this sector, the Bio-fuel companies-both public and private sector along with the farmers undergoing Jatropha cultivation are facing lot of uncertainties due to slow developments in government proceedings. The Ministry of New and Renewable Energy has been designated as the Nodal Agency for overall coordination relating to the development of Bio-fuel in the country and preparation of a national Policy on Bio-fuels.

Bio-fuels (ethanol from sugarcane) in vehicles have a significant contribution in Brazil reducing oil consumption by nearly 40 per cent. The US has successfully tried ethanol form maize and bio-diesel from soybean. India has the best chance with bio-diesel from Jathropa seeds. We have a mandate of mixing 5 per cent of petrol with ethanol. There is an urgent need for India to focus on alternative energy and leverage usage of electricity in both public and private transport. Since hardly any solutions have been explored so far, possibilities abound. Many solutions are in front of our eyes-solar energy, bio-fuel and green buildings. What is lacking is an initiative that has to come from the government and must be taken up by the private sector as well as the citizens. Power sector reforms need to be stepped up. Pricing is crucial, otherwise private players will be reluctant to invest.

Ethanol will come from agri-waste

In India ethanol is manufactured from sugarcane even though it affects the country's sugar production. The US and the UK use corn kernels and wheat that happen to be too valuable food products, and therefore unfeasible options for India. The US also uses soybean, Malaysia palm oil and Europe sunflower to extract biodiesel but all that is unviable for India, considering its shortage of edible oils. Our best options remain non-edible oil seeds like jatropha and pongamia besides newer technologies that use agricultural waste.

New technology could lower cost of production

Next generation cellulose technology can extract ethanol from wood, straw and even crop residue according a recent assessment of India's Biofuel Industry by UNCTAD. This process is complex and expensive, but work is being done on biotechnological innovations to make it more affordable. In case of China, cellulosic technology could lower cost of production to as little as $0.60 per gallon, making it the cheapest biofuel in the world. Other energy efficient production methods like membrane separation can further bring down the production cost, the report adds. New

skid mounted technology makes it possible to quickly set up a 9,000 tonnes per year biodiesel plants as compared to the large 80,000 tones per year plant being set up in India for demonstration purposes. Another successful technology if Fischer Tropsch that converts biomas to diesel. Biomass is first converted to syngas that is further converted into diesel. The final product consists of 80 per cent diesel and 20 per cent naphtha. The utilization of the byproducts of biodiesel can further bring down the cost of production and add to its economic viability. There is a need to develop ways to detoxify the meal cake in a cost effective manner so that it can be used as fertilizer. Technology for purifying glycerol, another byproduct, also needs to be developed. India's biofuel research remains in its infancy. The area under generally improved trees also be increased for better quality and quantity of oil. A report by the energy and resource institute illustrates an example of the Karnataka Government where a 10 per cent blend of Karanja oil was used to run two new buses. The trial run found an overall increase of 12.5 per cent in mileage and a saving of Rs. 3 per litre by using the blend over diesel. Unlike hydrogen fuel cell technology, biofuel technology is well within our reach. With a little more research and right policies, we might be able to grow our fuel in a sustainable, economical and environment friendly manner.

Rajasthan to lease land to grow jatropha

The Rajasthan government decided to lease out 48-49 lakh hectares of barren land to various organizations, including private companies, to cultivate jatropha (Ratanjot) and karanj plants for producing biofuel. CM confirmed that proposals for producing biofuel have been received from various companies like Reliance, Indian Oil and Hindustan Petroleum.

Field to the wheel

Some important activities are as:

1. Plantation

Jatropha, the wonder plant, is a large shrub/small tree that produces seeds with oil content upto 37 per

cent. These drought resistant perennial plants grow easily with minimal inputs or management. In addition, they are valued for crop protection as they prevent wind/water erosion, are not browsed by animals and have a 50 year life span.

2. Extraction

Its yield begins from the third year and continues for 25-30 years. The annual yield ranges from 0.5 to 12 tonnes. Seeds once dry, are separated, cleaned and processed.

3. Processing

Involves removing glycerin and biodiesel by adding a catalyst. Once the mixture settles, glycerin is left at the bottom and biodiesel floats to the top. The byproducts include a good organic fertilizer and an insecticide oil.

4. Blending

Once separated, biodiesel is washed with warm water, dried and sent to storage. This biodiesel contains no petroleum, but can be blended or mixed at any level with petroleum to create a biodiesel blend.

5. Retail sale

Biodiesel can easily operate in compression ignition and hence requires little or no engine modifications upto 20 per cent blend. According to a National Renewable Energy Laboratory study, use of biodiesel reduces CO_2 emission by 78 per cent.

Advantages

Biofuel has the potential to increase energy security, create new economic opportunities in rural areas, reduce local pollution and emission of greenhouse gases. The sector also generates a significant number of jobs. The ethanol industry is credited with providing more than 200,000 jobs in the US and 500,000 jobs in Brazil.

Disadvantages

Disadvantages include additional land use, as shifting food crops to fuel production could further tighten food supplies and raise prices. Their economic sustainability is also under debate. An other related disadvantage is the need to transport biofuel.

Conclusion

The United States and some European countries are producing biodiesel as a transport fuel by converting surplus edible oil such as soybean oil, sunflower oil and rapeseed oil. A biofuels mission focusing specifically on pongamia and jatropha is also launched. India's biofuel research remains in its infancy. The area under generally improved trees also be increased for better quality and quantity of oil. Unlike hydrogen fuel cell technology, biofuel technology is well within our reach. The ethanol industry is credited with providing more than 200,000 jobs in the US and 500,000 jobs in Brazil. With a little more research and right policies, we might be able to grow our fuel in a sustainable, economical and environment friendly manner.

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Focussed Crops

Technology led Horticulture Development for Inclusive Growth

Indian agriculture has achieved rapid strides in the last decades by taking the country from food scarcity to self sufficiency. However, the GDP contribution has declined significantly from 45.5% in 1950-51 to 18% in 2008-09. Due to positive interventions, in terms of various missions, agriculture has achieved the growth rate of above 4% consecutively for the last two years. Critical examinations of agricultural growth clearly indicate that horticulture has contributed significantly. One of the significant developments in horticulture is that it has moved from rural confines to commercial production, and this changing scenario has encouraged private sector investments. The sector contributes 29.5% to GDP of agriculture and has achieved the growth rate of 5-6% during the last decade. Horticulture, which was a pleasantry before independence, has emerged as a core sector in agriculture passing through the various phases. Investments made in horticulture during three plan periods have been highly productive in transforming agrarian economy in many of the states.

Scenario of Indian Horticulture

Past trend in development has been satisfying in terms of technological adoptions, production, availability and export of horticultural produce, and this trend has been marked as **"Golden Revolution".** The expansion of horticulture in non-traditional areas resulted in increase in area under fruits from 3.8mha in 1999 to 5.81mha in 2008 with an increased production of about 20mt. The area under vegetable cultivation also showed a similar increase of 1.85mha from 1999-2008 with an increased production of 34.67mt. India has emerged as second largest producer of fruits and vegetables and occupies first position in several horticultural crops and is the second largest producer of fruits (62.8mt) contributing 11% to the global fruit production. The area under fruit crops in India is 5.81mha with a production of 62.86mt. India occupies first place in the production of mango, banana, papaya, pomegranate, sapota and aonla. Vegetables occupy 7.73mha with total production of 122.26mt and productivity of 15.82t/ha. Presently, India's contributes 13% to the world vegetable production. Production and export of flowers have increased manifold and the country has a major stake in global trade of spices and cashewnuts. Export of medicinal plants, fruits and vegetables have also exhibited rising trend. Admittedly, the sector is moving dynamic despite numerous challenges and shortcomings and is in crucial phase of development.

Dr HP Singh

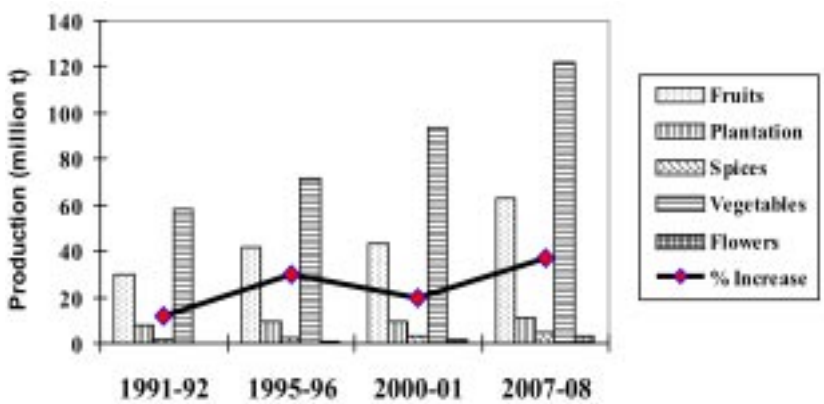

Fig. 1. Increase in production of horticultural crops over decades

Table 1. Projected demand of horticultural crops during 2020-21

Commodity	Production (mt)			Growth
	1998-99	2011-12	2020-21	rate (%)
Fruits	44.04	81.00	98.00	7.8
Vegetables	87.53	185.00	220.00	9.2
Spices	2.91	5.50	650.00	8.0
Coconut	10.27	20.00	24.00	8.4
Cashew nut	0.46	1.70	2.00	25.1
Cocoa, other	3.00	6.80	9.50	11.1
Total	**146.82**	**300.00**	**360.00**	**9.0**

Source: Singh, HP, 2007, Indian Horticulture, 52(4)

Challenges in Horticulture

Productivity of many of horticultural crops continues to be low. Quality of produce needs improvement, resource use efficiency requires up gradation, post-harvest losses continue to be high and there is growing regional disparity in production and use of technologies. The Government has addressed many of these constraints with added thrust in last three plan period. Technology Mission for Integrated Horticulture Development in North-East Region including Sikkim and Himalayan states has created awareness across the country. Subsequently national horticultural mission and micro irrigation have been launched.

RESEARCH EFFORTS

Infrastructure for technology development

The horticultural research in the country is being carried out at ten ICAR institutes (with 24 regional stations), 6 Directorates and 7 National Research Centres (on major crops). Area specific, multi-disciplinary research is also being conducted under 13 -AICRPs each on Tropical, Sub-Tropical, Arid Fruits; Vegetables, Potato, Tuber Crops, Mushroom; Floriculture, Medicinal and Aromatic crops, Betelvine, Palms, Cashew, and Spices at 251 centres located at various research Institutes, and State Agricultural Universities. In addition, several net work projects are now in operation. Research on horticulture is also being undertaken at Departments of Horticulture in 34 Agricultural Universities and three full fledged University of Horticulture and Forestry. The Horticulture Division of ICAR is responsible for national level planning and promotion of major research programmes in horticultural crops envisaging the emerging scenario.

Improvement in cultivars

Biotechnological tools are used in many crops such as brinjal, tomato, capsicum while association mapping (linkage disequilibrium) is used in case of perennials such as black pepper, cardamom and coconut. Gene pyramiding to converge useful genes in one back ground variety of commerce is the mainstay of biotechnological research and is in progress in solanaceous vegetables. A large number of transgenics with *Cry-I* AB gene have been produced and are under intensive evaluation.

Quality planting material production:

Micro-propagation techniques in various fruits and spices are very effective in production of healthy planting material. Banana and potato are the success stories for quality planting material production in large scale. For cleaning of infected materials in citrus, shoot tip grafting technique has been standardized and serpentine method of quality planting material production has been developed in black pepper. To ensure the quality of planting material there is need for "seed and planting material health management system".

Nutrient Dynamics and its management

Monitoring soil health and leaf analysis in fruit crops will be useful to ensure a balanced nutrient management and safeguard against hidden hunger as well as luxury consumption by horticultural crops. Use of liquid forms of fertilizers through fertigation and use of bio-fertilizers, VAM fungi, biological N fixers and other beneficial microbial

agents also need to be optimally used to attain an efficient management. Besides, harnessing geographical information system (GIS) using remote sensing (RS) to address farmer/site specific management also assumes significance.

Value addition and post harvest technology

Value addition through dehydration of fruits and vegetables including freeze drying, dried and processed fruits, vegetables and spices and fermented products play an important role in horticultural crops. Development of new products like juice punches, banana chips and fingers, mango nectar and fruit kernel derived cocoa substitute, essential oils from citrus, fruit wines, dehydrated products from grapes, pomegranate, mango, apricot and coconut, grapes and fruit wines, value-added coconut products like snowball tender coconut, coconut milk powder and pouched tender coconut water (Cocojal) etc. are getting popular day by day. Improved blending/ packaging of tea and coffee have opened new markets. Consumer friendly products like frozen green peas, ready to use salad mixes, vegetable sprouts, ready-to-cook fresh cut vegetables are other major retail items. Low cost eco-friendly cool chamber for on farm storage of fruits and vegetables has been developed. For preventing the post harvest losses proper storage, cold preservation, packaging and

transport methods with Hazard analysis Critical Control Point (HACCP) norms have to be given more thrust.

Small policy interventions make a complete change leading to effective utilization of technology. Fruit beverages, especially wine attract excise duty, which has been constraint. With change in policy in Maharashtra and Karnataka for grape wine, there is an appreciable growth in vine grape production. Similar policy therefore is needed for all wines produced from fruits.

Horticulture Mechanization

There is a scope to introduce variety of hi-tech mechanization operations in horticulture for nursery management, transplantation of floricultural plants in greenhouses as well as other plants, harvesting, transporting, grading and packing operations. Harvester for mango, lime, sapota, guava, cassava & potato, cassava chipping machine, potato chipper, shell fired copra dryer, solar-cum-electric dryer, potato digger, raised bed former-cum-transplanter-cum-planter for vegetable crops, coconut desheller machine and many others.

DEVELOPMENT OF HORTICULTURE:

The Horticulture Division in the Department of Agriculture and Cooperation, Government of India is vested with the responsibility of overseeing the overall accelerated development in the national perspective. The Division has the support of two Boards, Coconut Development Board and National Horticulture Board, Directorate of Arecanut & Spices Development Directorate of Cashewnut & Cocoa Development, National Committee on Plasticulture Applications in Horticulture (NCPAH). Besides the above, support for the development especially for marketing and export is also provided through Agriculture Produce Export Development Authority (APEDA) and Spices Board in the Ministry of Commerce.

Schemes for integrated development of coconut, post-harvest management, marketing and exports, capital investment subsidy for construction/ expansion/ modernization of cold storages for horticultural produce, human resource development in horticulture, technology mission for integrated development of horticulture in the North-Eastern Region including Sikkim and Himalayan states were implemented during the Ninth Plan. National Horticulture Mission was launched during X Plan which has been appreciated and has impacted the development of horticulture across the country. y

FUTURE CHALLENGES AND INITIATIVES

Measures to adapt to climate

change-induced changes are critical for sustainable production. High concentration of CO_2 may be beneficial if cultivars and technologies are made to respond to the situation. It is pertinent to mention here that Grape has been a temperate crop but with the manipulation in plant architecture and its management it has been possible to grow grapes in tropical conditions with highest productivity. The past experiences thus gives optimism that with appropriate support to research, the challenges of climate change could be faced without its negative impact.

- ü Dominance of Small farmers
- ü Seed and Planting Material Health Management
- ü Water Productivity Enhancement
- ü Options to use Technologies
- ü Organic Horticulture

REORIENTATION OF RESEARCH INITIATIVES

- Ø Increasing the value of production by reducing variability in yield, quality, reducing crop losses and increasing marketability
- Ø Develop system for productive use of water by increasing the water and nutrient use efficiency
- Ø Develop alternative to chemicals and fertilizers, integrated management and decision support systems
- Ø Develop the production systems that minimize wastes and maximize recycling.
- Ø Improve the understanding of interactions between native ecosystems and production systems and develop best practices to conserve biodiversity
- Ø Develop production and post-harvest technologies to improve product quality and minimize environmental impacts
- Ø Develop new innovative diagnostic techniques for rapid, accurate and cost effective detection of high impact pests and diseases
- Ø Understand social needs of communities and build the capabilities for practice change, and for effective utilization of resources and adoption of technology
- Ø Facilitate accelerated adoption of improved technologies and best practices and respond to needs including bio-security threats
- Ø Upgrade NRC as directorate for effective outreach programmes.

OPPORTUNITIES IN HORTICULTURE-LED INCLUSIVE GROWTH

Horticulture could prove a prime mover for inclusive growth and provide opportunities. The opportunities are for:

- · Research and development
- · Seeds and planting materials
- · Inputs like – fertilizers, pesticides, tools, irrigation system
- · Tools for mechanization
- · Harvesting and handling
- · Post harvest management and value addition
- · Decision support system.

Conclusion

Past efforts have proved beyond doubt that horticulture is the best option to improve livelihood, food and nutritional security with enhanced employment and increased income through value addition. Technology-led development addressing issues of production, consumption and policy supports provide ample opportunity to harness the potential. Sustained efforts are needed to improve competitiveness, enhance the efficiency of production system and establish linkages with various stakeholders to achieve sustainable transformation. Whatever efforts and investments that have been made, it has been highly productive so far but the future scenario with the climate change, declining land and water will be different. Given the time, the manpower and the financial assistance, our Indian scientist can take this challenge of the climate change and can avail the opportunities in future and definitely emerge as a leader not only in horticulture but in total agriculture. The technology of protective cultivation can give yield more than 3-4 times from the same area. Similarly, micro-irrigation enables to grow the crop with 50 per cent less water. Thus changes could be addressed, but will need investment in research and development and also enabling policy. Finally achieving enhanced productivity, profitability, equity and improving the quality of life of people through innovative horticulture shall be our set goal.

DDG (Horticulture),
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The Yellow Revolution on anvil

Dr DM Hegde and Dr RVenkattakumar

Dr DM Hegde

Introduction

Oilseeds account for 1.4% of GDP and 7% of value of all agricultural products (2004-05). About 14 million farmers are involved in oilseeds production and a million in processing. Vegetable oils contribute 12-13% of dietary energy of the Indian population. They also account for about 1.5-1.7% of national exports and about 15-17% of agricultural exports in the country (2006-07). The country ranks first in the production of castor, safflower, sesame and niger, third in rapeseed-mustard, fourth in linseed, fifth in soybean and seventh in sunflower in the world. In terms of area, India ranks first in castor, safflower, groundnut, sesame, rapeseed-mustard and niger, third in sunflower and linseed and fifth in soybean in the world. India has produced a record of 29.76 million tonnes of oilseeds during 2007-08 from an area of 26.69 million ha and productivity of 1115 kg/ha (2007-08). However, the production is expected to decline during 2008-09. The self-sufficiency in edible oil production fluctuates around 55-60% due to steady increase in the *per capita* oil consumption. As per the recent projections, the *per capita* consumption of vegetable oil likely to rise to 12.60, 14.57 and 16.38 kg/ha by 2010, 2015 and 2020 respectively. This vegetable oil requirement amounts to 14.8, 18.3 and 21.8 million tonnes respectively by 2010, 2015 and 2020. Assuming an average oil recovery of 30% from major oilseeds and proportion of different oilseeds constant in the coming years, the country needs to produce at least 44.8, 55.5 and 66.0 million tonnes respectively by 2010, 2015 and 2020. Given that the oilseeds production was 30 million tonnes in 2007-08, the country needs to almost double the oilseeds production in the next 12 years requiring an annual growth rate of above 6%. Also, the country has potential to double the current production of vegetable oils from supplementary sources.

Table 1. Oilseeds production in India

Crop	Production ('000 t)	
	2007-08	2008-09*
Groundnut	9183	7304
Castor	1054	1124
Sesame	757	694
Niger	110	115
Soybean	10968	10153
Sunflower	1463	1127
Rapeseed-mustard	5834	7315
Linseed	163	135
Safflower	225	157
Total	**29755**	**28127**

-3rd advanced estimates, Agricultural Statistics Division, Department of Agriculture and Cooperation, 2009

Research scenario

Breeding strategies on major abiotic (drought) and biotic (foliar disesses and aflatoxin contamination) stresses, eco-regional adaptation and enhanced yield potential are to be addressed. The management practices should be location-specific, variety-specific and farmer-specific. Informal seed sector must be strengthened to meet the huge demand for quality seed of groundnut. Rapeseed-mustard are the premier winter oilseed crops in India. Nearly 140 improved cultivars have been bred in the last few decades. CMS-based hybrids are now commercialized and these promise substantial productivity enhancement. Success has also been achieved in selective modification of fatty acid composition as well as meal glucosinolates. Except for white rust, attempts to breed disease or insect resistant cultivars have not been very successful. Inspite of release of CMS-based hybrids in mustard, there is a need for continuous focus on improving available CMS sources and enhancing heterosis.

The yield levels of soybean have been increased

Table 2. Domestic production, imports, per capita consumption and self-sufficiency of edible oils in India

Year	Edible oil Production ('000 t)	Import of edible oils ('000 t)	*Per capita* consumption	Self-sufficiency (%)
2000-01	55.0	41.8	9.4	57
2001-02	61.3	43.2	10.0	59
2002-03	51.5	43.6	8.8	53
2003-04	75.8	52.9	10.5	59
2004-05	75.9	45.4	10.1	63
2005-06	91.0	54.3	11.6	63
2006-07	80.0	62.0	11.2	56
2007-08	91.4	51.8	12.2	64

by 60% in the last 60 years and 3900 varieties have been released world wide. Besides molecular approaches, new conventional approaches like hybrid soybean and population improvement need better attention for further improvement in the genotypes available.

The average yield of sunflower, 600-700 kg/ha in India is much lower than the world average. The crop improvement initiatives in India have focused on yield improvement through superior hybrids and open-pollinated varieties. The limited genetic variability in working germplasm has restricted genetic advances emphasizing the need for identifying heterotic gene pools and increasing diversity by the infusion of genes from wild relatives. Considering the adverse ecologies in which sunflower is cultivated, breeding research should address to geographical or regional requirements. However, seed yield and oil content will continue to be important traits in crop improvement.

In sesame, development of hybrids should receive priority with due attention for searching a genetic-cytoplasmic male sterility mechanism or linked markers. Attention should be paid for tolerance/resistance to prolonged drought, excessive moisture/stagnant water, salinity and alkalinity stresses. Genotypes with positive response to higher inputs of fertilizers should be developed. Studies to develop reliable, reproducible screening methods for the key diseases/insect pests and abiotic stresses are required. A breakthrough in breeding for resistance to phyllody will have the most significant effect on sesame yields, especially in Southeast Asia.

Available safflower cultivars could enhance productivity level of safflower by about 30-40%. However, the average productivity of safflower in the country is still low. Limited genetic diversity for agronomically important traits, low genetic advance, variation of expression of individual traits as well as yield in different environments, and biotic and abiotic stress conditions are some of the major constraints for achieving quantum jump in productivity of safflower.

The cultivation of linseed under input-starved condition, *utera* system of cropping and major linseed growing areas under dryland/moisture stress situations are the major impediments for the low productivity at national level. The value addition properties of linseed with respect to industrial and medicinal needs to be emphasized.

In castor, special focus is required for the development of hybrids and varieties resistance to abiotic stresses *i.e.,* drought and salinity, highly stable and diverse pistillate lines, resistant to biotic and abiotic stresses and to develop high yielding hybrids/varieties suitable for various situations.

India is endowed with vast potential of oilseeds of tree origin like sal, mahua, simarouba, jatropha, karanja, etc., being collected and crushed for vegetable oil. The re-

Table 4. Exploitable yield reservoir in oilseeds (1996-97 to 2006-07)

Crops	FLD average yield (1996-97 to 2006-07) (kg/ha)	National average yield (kg/ha) (2006-07)	Yield gap (%)	National average production ('000tonnes) (2006-07)	Expected production ('000tonnes)
Groundnut	2249	866	160	4863.5	12628.4
Rapeseed mustard	1405	1095	28	7437.8	9540.0
Sunflower	1492	567	163	1227.5	3229.9
Safflower	1272	637	100	240.3	479.5
Soybean	1819	1063	71	8850.8	15149.9
Sesame	644	363	77	618.4	1096.9
Niger	489	258	90	120.9	229.3
Castor	1840	1213	52	762.3	1156.3
Linseed	949	385	147	167.9	414.2
	Overall			**24289.4**	**43924.4**

Yield gap =Increase in FLD average yield over national average yield expressed in percentage; Expected production=Expected production, if yield gap is bridged through complete adoption of improved practices.

search efforts should be directed towards identification of superior clones/genotypes, producing better quality and quantity of the oil, high seed yield and possessing synchronized maturity.

For oil palm, programmes need to be focused on enrichment of germplasm base, increasing the oil yield per unit area, developing cultivars that perform well under moisture stress conditions and the types that are easily amenable for harvesting. For coconut, still efforts are needed to strengthen the germplam base to obtain variability with drought tolerance, pests and disease resistance, to develop highly profitable and location-specific coconut-based cropping and farming systems and labour saving machineries in crop management. Research and extension efforts are to be strengthened in cotton to increase the oil and protein content of the seed and development of gossypol-free cotton seed, apart from popularizing the scientific processing of cotton seed, so that the quantum of oil extracted from this crop can be doubled.

The crop production technologies in oilseed crops especially agronomic technologies have to be refined. Suitable crop management strategies based on the use of innovative agro-techniques for enhanced oilseed production, for enhanced resource use efficiency, crop physiological approaches, enhancing agronomic performance through improved machinery and other non conventional interventions for yield enhancement are some of the key areas for oilseed crop research. The research potential in areas like nutrient and water use efficiency, nutrient interactions, role of micronutrients, source-sink relationship and modification of assimilate portioning mechanisms in oilseed crop management are to be addressed on priority basis. Developing a push-pull strategy to ward-off insect pests while attracting their natural enemies, modification of plant biochemistry to make the plants less attractive to herbivores, establishing crop habitat diversity and deploying eco-feast crops to encourage parasitoids and predators could provide answers to some serious pest problems. Biological control agents like pathogens, parasitoids and predators have been genetically improved for enhanced performance. Application of genomics will also enable the identification of protein that can be targeted by biorational insecticides. Nanotechnology is a rapidly emerging technology which can be utilized to develop highly effective insecticides with enhanced action.

Processing and value addition

The lack of adequate integration between expelling units and solvent extraction, and refining units alone

Table 5. Yield losses due to insect pests and diseases

Crop	Yield loss (%)			
	Insect pests		Diseases	
	Range	Average	Range	Average
Groundnut	3-40	6	5-59	8
Rapeseed-Mustard	1-83	15	1-70	15
Sunflower	12-42	24	1-90	20
Safflower	20-68	30	5-40	15
Sesame	10-40	20	5-30	15
Niger	15-30	20	5-35	20
Castor	10-50	15	5-40	15
Linseed	17-49	25	5-100	30
Soybean	10-50	20	10-90	15

is costing the country in a very big way. From a production of 141million tonnes of paddy during 2007-08, only 7 lakh tonnes of rice bran oil was extracted, although there was a potential of 14 lakh tonnes. Therefore, the strategies for increasing edible rice bran oil production are, to make available remaining 40-50% of the bran for oil production, to utilize existing stabilization processes so that more refined oil is recovered after physical or chemical refining and to recover high value by-products which have application in food and allied industries. This approach can yield 7 lakh tonnes of extra oil valued at Rs.1050 crores and by-products to the tune of Rs.1600-2500 crores/ annum. Oilseeds are primarily consumed for their oil content so it is necessary to ensure the ideal fatty acid composition for specific applications. Secondly, it is also necessary to fully exploit commercial potential of the non-oil components in oilseed cake. Therefore, the developmental efforts for ideal cooking oil for domestic and bakery applications with high mono saturated fatty acids are to be addressed. In this regard, the potential of value chain for linseed to promote linseed cultivation and its utilization for omega-3 nutritional security is to be explored. The phytochemicals in oilseed cake and their antioxidant activity and their possible applications as functional food are to be addressed.

Transfer of technology and marketing

As per national seed plan 2005, seed replacement rate for varieties of self pollinated, cross pollinated crops and hybrids should be 25, 35 and 100% respectively. A large proportion of Indian farmers use farm-saved seeds of low yielding varieties. Appropriate policy environment, remunerative prices for producers, upgradation of production technology and efficient markets are essential to accelerate growth in oilseeds to keep pace with growth in domestic demand. Domestic price policy and domestic market and trade policy have remained adverse to oilseed sector in most of the period during last three decades. There is a need for paradigm shift in public sector transfer of technology from top-down, blanket dissemination of technologies towards facilitating learning and understanding. The prevailing transfer of technology modes and approaches need to emphasize on learning and skill development rather on knowledge and technology *per se* which generally are contextual at a given time and space and hence limited for their transferability. Greater attention will have to be paid to information-based technologies.

Conclusions

The oilseed sector constitutes an important determinant of agricultural economy in India. The country may have to almost double the vegetable oils production by 2020 if it has to achieve near self-sufficiency. This is indeed a tall order requiring a growth rate in excess of 6% per annum. Favourable policy framework for the oilseed sector with respect to processing, marketing and trade is the basic and overarching requirement to achieve self-reliance in vegetable oils. Given a desired policy frame work in place, oilseeds production can be increased to a limited extent by area expansion through replacement of non-remunerative crops, extension in rice-fallows and problem areas, intercropping in widely-spaced crops, as options in contingency planning, introduction in water-scarce areas, diversification of rice-rice and rice-wheat systems and by increasing competitiveness of oilseeds through value addition. There is limited scope to bring additional area under oilseeds and bulk of the future increases in oilseeds production has to come primarily from land-saving technologies. This calls for giving new thrust for improving the productivity of oilseed crops by use of quality seed, providing protective irrigation, resorting to efficient crop zoning, enhanced and integrated nutrient use, farm mechanization, efficient crop management, overcoming biotic and abiotic stresses through novel approaches and effective technology transfer to bridge yield gap. This requires effective contribution by all those concerned with oilseed sector to the best advantage of oilseed farmers to achieve self-reliance in vegetable oils.

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SPICES SCENARIO

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Spices, the high value and low volume commodities of commerce, are the fast growing food industry world over. Health conscious consumers in developed countries prefer natural colours and flavours of plant origin to cheap synthetic ones. The estimated growth rate for spices demand in the world is around 3.19%, which is just above the population growth rate. India has been a traditional producer, consumer and exporter of spices. There are about 109 spices listed by International Organization for Standardization and India grows about 60 of these spices. During the crop year 2006-07, the country produced about 3944.2 thousand tons from 2410.8 thousand hectares of area under spices. Of the total production, nearly 9.5% was exported. Share of export in total production varied from mere 0.6% in tamarind to about 72% in nutmeg and mace (Table 1). Financial year 2007-08 was the year of record export both in terms of value and volume.

Dr V A Parthasarathy

Trends in growth of major spices

Black Pepper

While area augmentation has grown at the rate of 0.85%, production has grown at the rate of 2.38% during 1987-88 to 1997-98. Area under pepper has crossed the 2.33 lakh ha mark during the crop year, 2003-04 and during 2006-07, the area is 2.46 lakh ha with the production of 69 thousand tonnes and 281kg/ha productivity. Pepper productivity in India is one of the lowest in the world. The average productivity of pepper/vine is highest around 1kg in Karnataka and lowest around 0.6kg in Kerala. In 2008-09, India exported about 25,250t valued Rs.413.7 crores, a reduction of 28% in volume and 20% in value over 2007-08. USA is the major importer of pepper in the world market with an average import of about 60,000t per annum and in 2008-09, USA imported 10,050t of

Crop/ Product	Production (2006-07)			Export (2006-07)		Share in Export		Export
	Area ('000 ha)	Production ('000 MT)	Productivity (kg/Ha)	Qty. (M.T)	Value (Rs. Lakhs)	Qty. (%)	Value (%)	as % of Production
Black Pepper	246.0	69.0	281	28750	30620	7.7	8.6	41.7
Cardamom	98.2	15.7	160	650	2236	0.2	0.6	4.1
Chilli	757.9	1234.1	1628	148500	80775	39.7	22.6	12.0
Ginger	105.9	370.3	3497	7500	3975	2.0	1.1	2.0
Turmeric	186.0	837.2	4501	51500	16480	13.8	4.6	6.2
Coriander	320.8	233.2	727	20500	7462	5.5	2.1	8.8
Cumin	349.0	158.4	454	26000	20150	7.0	5.6	16.4
Celery	-	-	-	3550	1321	0.9	0.4	-
Fennel	43.5	61.7	1418	3575	2380	1.0	0.7	5.8
Fenugreek	32.7	35.7	1093	8500	2699	2.3	0.8	23.8
Garlic	150.1	710.5	4734	11500	2128	3.1	0.6	1.6
Ajowan	14.5	4.4	305	-	-	0.6	-	-
Other seeds[1]	17.7	10.7	605	8000	2240	2.1	0.6	74.7
Clove	2.0	1.0	506	-	-	-	-	-
Nutmeg	11.3	2.9	256	2100	4274	0.6	1.2	72.4
Tamarind	60.6	189.2	3121	1200	3000	0.3	0.8	0.6
Cinnamon	0.9	1.7	1928	-	-	-	-	-
Vanilla	-	-	-	125	1996	0.0	0.6	-
Tejpat	3.8	8.3	2202	-	-	-	-	-
Other spices	9.9	0.3	27	18300	4280	4.9	1.2	
Curry powder /paste	-	-	-	9500	8693	2.5	2.4	-
Mint products	-	-	-	16250	110095	4.3	30.8	-
Spice Oils & Oleoresins	-	-	-	6250	51079	1.7	14.3	-
TOTAL	**2410.8**	**3944.2**	**1636**	**373750**	**357575**	**100.0**	**100.0**	**9.5**

Table 2. Share of major items in Indian spice exports (2008-09)

Spice	Qty (t)	%	Value (Rs. Crores)	%
Black Pepper	25250	5	413.7	8
Chilli	188000	40	1080.9	20
Cumin	52550	11	544	10
Coriander	30200	6	203.8	4
Turmeric	52500	11	248.6	5
Mint Products	20500	4	1420.2	27
Oil & oleoresin	6850	1	720.5	14

Source: Spice India, 2009, 22(7): 4-12.

Table 3. Estimated Export of spices from India (Quantity in MT, Value in Rs. Lakhs)

Crop	2004-05		2008-09		% change in 2008-09	
	Qty	Value	Qty	Value	Qty.	Value
Black Pepper	11500	9891.5	25250	41374	119.6	318.3
Cardamom (small)	500	1852.0	750	4727	50.0	155.2
Chillies	114000	42120.6	188000	108095	64.9	156.6
Ginger	11050	4380.8	5000	3483	-54.8	-20.5
Turmeric	36000	13298.8	52500	24858	45.8	86.9
Coriander	30250	7382.6	30200	20379	-0.2	176.0
Cumin	12200	9001.3	52550	54400	330.7	504.4
Nutmeg & mace	1125	1955.8	2155	6075	91.6	210.6
Vanilla	160	2313.0	305	2670	90.6	15.4
Curry powder	6300	5193.0	13250	16375	110.3	215.3
Mint products	5350	23122.5	20500	142025	283.2	514.2
Spice Oleoresins & oils	4560	37590.3	6850	72050	50.2	91.7

Source: DASD & Spices Board, Govt. of India.

pepper accounting for 40% of our total pepper export. Other major buyers are UK (1475t), Italy (1290t), Canada (1265t) and Germany (1200t).

Cardamom

The year, 1978 - 87 observed a period of increasing trend and 1989-90 to till date a period of decline. During 1990s, India's production had been showing a consistently increasing trend from 4250t in 1992-93 to 7900t in 1995-96, but declined to 6625t during the subsequent crop year with a lower rate of decline. The increasing trend in production from the crop year, 1997-98 is being maintained till date with 11,580t in the year 2003-04 and 15,700t in 2006-07 from 98,200 ha. India exported 750t of cardamom worth Rs.47.27 crores in 2008-09 recording an increase of 50% in volume and 91% in value as compared to 2007-08. Saudi Arabia is the major importer with 520t (69%) of our total cardamom export. Other major buyers are Malaysia (30t), Japan (25t) and UAE (20t).

Ginger

Area under ginger has increased over the years from 1970-71 to 1999-2000, with occasional fluctuations attributing to ups and downs in price. Indian production has been steadily increasing from 29.59 thousand tonnes in 1970-71 to 370.3 thousand tonnes during 2006-07. While Meghalaya, Arunachal Pradesh, Sikkim and other NE states together accounted for more than 52% of total production with 26% of area under ginger in the country, the region comprising Kerala, Karnataka, Orissa and Tamil Nadu accounted for the rest of the production with 72% area during 2006-07. India exported 5000t of ginger valued Rs.34.8 crores in 2008-09 recording a reduction of 34% in volume but 24% increase in value as compared to 2007-08. Maximum export of ginger is in the dry and powder forms and fresh ginger export which accounts for about 50t is mainly from the NE states to Bangladesh. Saudi Arabia is the major importer with 415 t (69%) along with UK (480t)

of our total export. Other major buyers are Spain (305t) and Morocco (240t).

Turmeric

India produced 837.2 thousand tonnes from an area of 186 thousand ha with the productivity of 4.50t/ha during 2006-07. Andhra Pradesh occupies first position both in terms of average area and production, but from the point of view of productivity, Andhra Pradesh occupies the third position. India exported a record high 52,500t of turmeric valued Rs.248.6 crores in 2008-09 with an increase of 6.6% in volume and 58% in value as compared to 2007-08. UAE is the major importer with 5910t of our total export. Other major buyers are Iran (5335t), Bangladesh (4595t), Malaysia (4825t) and Japan (3090t).

Chillies

India produces about 8-10 lakh tonnes of Chillies per annum. Exports are of the order of 1.8-2 lakh tonnes, which is 15% of the total production. The important States growing chilly in terms of production are Andhra Pradesh (63%), Karnataka (12%) Orissa (5%), Maharashtra (4%), West Bengal (5%), Tamil Nadu (3%) and Rajasthan (1%). The total production in the country is around 12.34 lakh tonnes from 7.57 lakh ha in the country (2006-07). The average productivity in the country is around 1628kg/ha. Andhra Pradesh has the maximum productivity of 3579kg/ha.

Chilly occupies the first position in volume (40%) of spice export from our country with second position in terms of value (20%). India exported 1.88 lakh t of chilly worth Rs.1080.9 crores in 2008-09. Malaysia is the major importer with 40615t of our total export. Other major buyers are Srilanka (37790t), Pakistan (22375t), UAE (18815t) and USA (15680t) during 2008-09.

Tree Spices

Clove, nutmeg, cinnamon, comboge, kokum etc are the predominant tree spices cultivated in India. The production of clove in India during 2005-06 was 1003t from an area of 1981ha. Nutmeg is cultivated in an area of 11,329ha with the production of 2902t. Cinnamon is commercially cultivated in Kerala, Karnataka and Andaman & Nicobar Islands with production of 1668t from an area of 868ha.

Seed Spices

Seed spices cover about 8.72 lakh ha with a production of 5.69 lakh tonnes annually. Coriander (3.52 lakh ha), cumin (4.03 lakh ha), fenugreek (0.32 lakh ha) and fennel (0.46 lakh ha) are the major seed spices grown. Major producing states are Rajasthan, Gujarat, MP, Haryana, Punjab, UP, AP, Tamil Nadu, Karnataka etc.

About 80% exported is for raw seed spices and it recorded a substantial increase in quantity and value during 2008-09 contributing to 28% in volume and 18% in value of total spice export from India. Cumin occupied the first position in volume (52550t) of seed spice export followed by coriander (30200t) with a value of Rs.544 and Rs.203.8 crores, respectively. UAE (12810t) is the major importer of cumin. The major buyers of coriander are Malaysia (7050t), UAE (5450t), Pakistan (3215t) and Saudi Arabia (2475t) during 2008-09.

Processed Spices

During 2008, 13250t of curry powder blends worth Rs.163.7 crores has been exported to UK, Saudi, UAE and USA. Export of spice oils and oleoresins has recorded an all time

Table 4. Direction of Indian spice exports (%)

Regions	1990-91 Quantity	2000-01 Value	2008-09 Quantity	Value	Quantity	Value
America	13.2	19.2	21.0	31.3	12.0	23.0
European Union	13.2	17.6	12.6	19.5	10.0	17.0
Asia	51.8	29.9	56.8	42.0	66.0	48.0
Africa	1.7	0.8	6.0	2.9	8.0	5.0

Table 5. Potential for productivity increase at the national level

(kg/ha)

Crop	National	Progressive Farmer	Research	Abroad station
Pepper	315	2000	2445	2925 (Malaysia)
Cardamom	174	1625	450	250 (Guatemala)
Ginger	3477	5500	8250	-
Turmeric	3912	6200	10700	-
Coriander	591	-	1900	515 (Morocco)
Cumin	578	-	2000	-

Spice	Competing country
Black pepper	Indonesia, Brazil, Malaysia, Thailand, Sri Lanka, Vietnam, China (P.R), Madagascar, Mexico
Cardamom (small)	Guatemala, El Salvador, Indonesia, Malaysia, Papua New Guinea, Sri Lanka
Ginger	China (P.R), Thailand, Japan, Bangladesh, South Korea, Malaysia, Fiji, Philippines, Jamaica, Nigeria, Sierra Leone
Turmeric	China (P.R), Pakistan, Bangladesh, Thailand, Peru, Jamaica, Spain
Clove	Brazil, Indonesia, Madagascar, Malaysia, Papua New Guinea, Sri Lanka
Nutmeg and Mace	Grenada, Guatemala, Mexico, Nicaragua, Sri Lanka
Cassia	China, Indonesia, Madagascar, Malaysia, Vietnam, Sri Lanka
Cinnamon	Madagascar, Papua New Guinea, Seychelles

Table 6: Estimated production target for spices in India

(Qty. = tons)

Year/ Spices	Spices	Black [1] Pepper	Cardamom (s)[2]	Ginger[3]	Turmeric[1]
2006-07	3787812	82882	19423	391537	672478
2011-12	4268221	92658	36159	500558	776905
2016-17	4810895	103733	67535	640934	897816
2021-22	5416858	115362	126330	819999	1037830
2026-27	6103366	128570	236580	1051128	1200210

Note: 1-With 80% import reduction; 2-With 0% import; 3-With 60% import reduction

high of 6850t worth Rs.720.5 crores in 2008-09. Major spice oils exported are Pepper oil, nutmeg oil, mustard seed oil, clove oil, celery seed oil and ginger oil and in case of oleoresins, paprika oleoresin followed by capsicum, pepper, garcinia and turmeric oleoresins are exported. USA is the major importer of spice extracts followed by Germany, UK, South Korea and China. Mint products account for 27% of the total spice export and it is mainly exported to USA, China, Singapore, Germany, Netherlands and Japan.

Imports

The total import of spices in India during 2008-09 is about 83545t valued at Rs.765.4 crores. The major spices imported are pepper, poppy seeds, clove, cardamom, ginger fresh and cassia. Out of the total import of pepper (10750t) more than 60% is light (immature) pepper for oleoresin industry extraction and re-export. Fresh ginger is imported mainly from Nepal (30%). Poppy seeds, cassia, clove and star anise are also imported to meet the domestic consumption.

Table 7. Improved Cultivars/Hybrids available in Major Spices

Spices	Cultivar/Hybrid
Black pepper	Panniyur-I, Panniyur-2, Panniyur-3, Panniyur-4, Panniyur-5, Panniyur-6 & Panniyur-7, Sreekara, Subhakara
	Panchami, Pournami, IISR-Thevam, IISR-Girimunda, IISR-Malabar Excel, IISR-Shakthi
Cardamom (small)	Mudigere-I, Mudigere-2, PV-I, PV-2, ICRI-l, ICRI-2 & ICRI-3, ICRI-4, ICRI-5, ICRI-6, Avinash, Vijitha, Suvasini
Ginger	Suprabha, Suruchi, Surabhi, Himagiri, Varada, Rejatha, Mahima
Turmeric	CO-1, Krishna, Sugandham, BSR-I, Suvarna, Roma, Suroma, Rajendra Sonia, Ranga, Rasmi, Mega Turmeric, RCT- I, Sudarsana, Suguna, Prabha and Pratibha, Alleppey Supreme, Kedaram
Cinnamon	Konkan Tej, YCD-1, PPI(C) -1, Sugandhini, IISR-Navashree, IISR- Nithyashree
Nutmeg	Konkan Swad, IISR-Vishwashree
Fenugreek	Co-I, Rajendra Kanti, Rmt-I, Lam Selection-I
Coriander	GC- I, Co-I, Co-2, GC-2, Rajendra Swathi, RCr-4, Sadhana, Swathi, Co-3, CS-287, Sindhu, UD-24, DH
Cumin	S-404, MC-43, GC-I, GC-2, GC-4, RZ-19
Fennel	S-7-9, PF-35, Gujarat Fennel-1, Co-1

Research and Development

The research on spices is being carried out at IISR, Kozhikode which also houses the AICRP on Spices (AICRPS). The AICRPS has a network of 35 centres spread across the country for developing agro-climate specific technologies. The research on seed spices is being carried out at National Research Centre on Seed spices, Ajmer. The research has led to the development of large number of varieties and technologies.

Strategies for Development

- Crop improvement and biotechnology
- Better planting materials
- Climate change on spices productivity
- Input use efficiency
- Emphasis on organic farming
- Pest and disease management
- Processing and value addition
- Quality-Clean Spices

Conclusion and future thrust

The major thrusts in research programmes are oriented towards the following for increasing productivity of spices.

- Conservation of genetic resources and bar-coding of genotypes
- Raising the productivity of spices to the targeted levels
- Increasing quality planting material production, crop management and replanting and rejuvenation of old gardens, GAP, INM and organic farming
- Increasing productivity of spices
- Developing simple and cost effective tools and machines
- Chemo profiling and identification of new flavour compounds, bio active principles for patenting
- New market oriented technologies for value addition, processing, product development
- Development of data bases, prediction models, production strategies and market intelligence

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Wheat Scenario in India

Dr SS Singh[1] and Dr SK Singh[2]

Dr SS Singh

India, one of the greatest success stories of Green Revolution, is the second largest producer of wheat in the world after China. Wheat is the second most important crop after rice in India and occupies approximately 27.7mha. The wheat production in India has touched a new height of 80.56mt in 2008-09 and the national wheat production accounts for approximately 12% of global wheat production. On the other hand, India is also the second largest wheat consumer after China. Thus, wheat and its various products play an increasingly important role in managing India's food security and India became the wheat surplus nation as against the wheat deficient nation during 1960's. The tremendous progress in area, production and productivity of wheat to the tune of 2.9, 12.2 and 4.2 times, respectively as compared to 1950 has made India the member of elite group of wheat exporting countries.

Production statistics of wheat in India

Crop year	Area (mha)	Production (mton)	Yield (t/ha)
1950-51	9.75	6.46	0.66
1960-61	12.93	11.00	0.85
1970-71	18.24	23.83	1.31
1980-81	22.28	36.31	1.63
1990-91	24.17	55.14	2.28
2000-01	25.73	69.68	2.71
2007-08	27.70	78.56	2.80

Source: Agricultural Statistics at a Glance, 2008

Wheat Production Scenario

About 91.5% of the wheat produced in six states *viz*., Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan and Bihar. On average basis of last five years, Uttar Pradesh with 24.25mt continues to be the highest producer of wheat followed by Punjab (14.67 mt) and Haryana (9.13 mt). The contribution from Haryana and Punjab is mainly attributed to their high productivity (4.0 to 4.3 tons/ha) whereas the contribution of other states such as Uttar Pradesh and Madhya Pradesh is due to relatively large area (approx. 50% of the total area) sown to wheat. The states of low wheat productivity have shown an increasing trend in grain yield per unit area in recent past but the stagnated productivity levels in highly productive states of Punjab and Haryana are posing a major concern for future production targets.

Statewise production statistics of wheat*

State	Area (m ha)	Production (mt)	Productivity (t/ha)
UP	9.13	24.25	2.7
MP	3.80	6.28	1.7
Punjab	3.44	14.67	4.3
Haryana	2.30	9.13	4.0
Bihar	2.07	3.72	1.8
Rajasthan	2.07	5.74	2.8
Gujarat	0.66	1.66	2.5
Maharashtra	0.78	1.03	1.3
West Bengal	0.41	0.89	2.2
Uttranchal	0.40	0.74	1.9
HP	0.36	0.60	1.7
Karnataka	0.25	0.17	0.7
All India	26.20	69.73	2.7

***Average of last 5 years**

Available irrigation for wheat crop

Nearly, 89% of the wheat area in the country is irrigated and most of it lies in north India. Wheat cultivation in top three wheat-producing states is supported by more than 95% area under irrigation. Rajasthan (99%) and Bihar (90%) also have most of the wheat area under irrigation. The central, peninsular and hilly areas of northern and southern regions grow mostly rainfed wheat whose success largely depends on residual moisture build up from monsoon, limited availability of water for irrigation and casual winter rains. Gujarat (87.5%), Madhya Pradesh (78.3%), Maharashtra (66.5%) and Karnataka (51.5%) has comperatively lower coverage of area under irrigation and rest of the area depends on rains that explains the cause of low productivity and scope for improvement through infrastructure development.

Wheat Procurement and Trade

Total procurement of wheat in India increased from 12.7-20.6mt during the period from 1998-99 to 2001-2002. The contribution of Punjab and Haryana was more than 80%. However, the procurement was reduced from 2002-03 and reached to the level of 9.2mt during 2006-07 due to decrease in production. MSP per quintal of grains increased from Rs.550 to Rs.750 per quintal during this period. Increase in MSP for wheat during 2007-08 to Rs. 1000 and then to Rs. 1080 during 2008-09 has resulted in quantum jump in the procurement of wheat to the tune of 22.2mt during 2008-09. Export of wheat, which was nominal during 1998-99 rised to 4.09mt in 2003-2004 but after that there has been no progress in export of wheat grains and negative trend in the export of wheat was shown that reduced to negligible quantity of only 230t during 2007-08. However, keeping in view of a sort of drought situation during the existing Kharif season, Govt. of India has put restrictions on export of wheat and non-basmati rice. On the other hand, India has imported 6.1mt wheat in 2006-07 and 1.8mt during 2007-08. This import is mainly attributed to the lowest buffer stock of 5.4mt in 2007 and slightly higher stock of 7.71mt in 2008. However, the buffer stock of wheat which is 33mt in 2009 is recorded to be the highest ever since 1991.

Advances in Technological developement

Varieties released

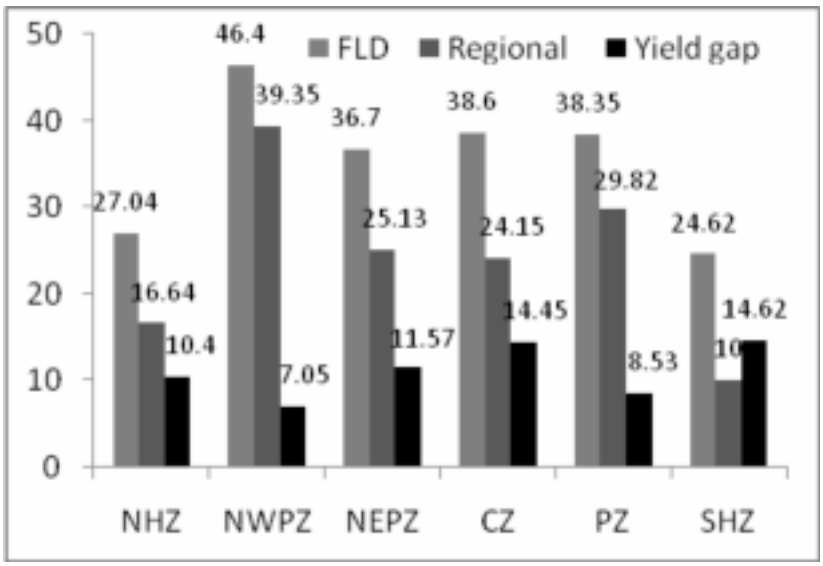
The Indian wheat improvement programme has significantly contributed to the release of 357 wheat varieties through Central Variety Release Committee (226) or State Variety Release Committee (131) for different agro climatic zones along with relevant production technology since inception of the All India Coordinated Wheat and Barley Improvement Programme in 1965. This included 302 bread wheat, 47 durum, 05 dicoccum and 03 triticale varieites. Some varieites released in recent past have contributed significantly to enhanced wheat production and among them, PBW 343 (NWPZ/NEPZ-7.0 m ha), HUW 234 (NEPZ- 3 m ha), Lok 1(CZ- 2.0 m ha) and HD 2189 (PZ-0.5 m ha) are notable. Besides this, more than 110 wheat genetic stocks have been registered with NBPGR, New Delhi for various biotic and abiotic stress tolerance as well as yield and quality components for their further utilization in wheat improvement programmes.

Resource Conservation Technologies

The zero tillage technology for seeding wheat without any field preparation has several advantages over conventional tillage. Besides saving energy, it reduces the cost of cultivation, advances the time of wheat sowing by 4-5 days, requires less water for the first irrigation and results in less infestation of *Phalaris minor*. Recent estimates suggest that around 2.0 million hectares area is under no-till/ zero till /reduced till which has potential upto 10m ha.

The Furrow Irrigated Raised Bed-planting System (FIRBS) is promising resource conservation tillage technology that saves about 25% seed and fertiliser alongwith reduced water usage by 25-40%. Rotary tillage technology is another option that gives highest productivity with the least specific energy requirement. The energy saving is more than 80% compared to conventional seeding of wheat as observed in farmers fields. To avoid the residue burning, a new machine

Wheat varieties for diverse agro-climatic and production conditions				
Wheat type	**Production conditions**			
	Normal sown	**Late sown**	**Rainfed**	**Sodic soils / Others**
North Western Plains Zone(NWPZ) *Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), Western UP (except Jhansi division), parts of J&K (Jammu and Kathua districts), HP (Una dist. and Paonta valley) and Uttarakhand (Tarai region)*				
Bread wheat	DBW 17, PBW 550, PBW 502, PBW 343, WH 542, UP 2338, HD 2687	WH 1021, PBW 373, UP 2425, RAJ 3077, DBW 16, RAJ 3765, PBW 590	PBW 299, PBW 175, WH 533, PBW 396	RAJ 3077, KRL-19
Durum	PBW 34, PDW 215, PDW 233, WH 896, PDW 291	-	-	-
North Eastern Plains Zone (NEPZ) *Eastern UP, Bihar, Jharkhand, Orissa, West Bengal, Assam and plains of NE States*				
Bread wheat	CBW 38, Raj 4120, K 0307, NW 1012, HUW 468, PBW 443, HD 2733, HD 2824, K 9107	HD 2643, HP 1633, HP 1744, NW 1014, HW 2045, DBW 14, NW 2036	HDR 77, K 8962, K 9465, K 8027, HD 2888, MACS 6145	RAJ 3077, KRL-19
Central Zone (CZ) *MP, Chhattisgarh, Gujarat, Rajasthan(Kota and Udaipur divisions) and UP(Jhansi division)*				
Bread wheat	GW 190, GW 273, DL 803-3, GW 322, GW 366, HI 1544, DL 803-3	GW 173, DL 788-2, MP 4010, HD 2932, MP 1203, HD 2864	HW 2004, JWS 17, HI 1500, HI 1531, Sujata	RAJ 3077, KRL-19
Durum	HI 8381, HI 8498	-	HD 4672, HI 8627	-
Peninsular Zone (PZ) *Maharashtra, Karnataka, Andhra Pradesh, Goa, plains of Tamil Nadu*				
Bread wheat	DWR162, MACS 2496, GW 322, Raj 4037, NIAW 917	DWR 195, HD 2501, NIAW 34, HUW 510, HD 2932, HI 977, HD 2833, PBW 533, Raj 4083	K 9644, HD 2781, PBW 596	_
Durum	MACS 2846, HI 8663, UAS 415	-	AKDW 2997-16	-
Dicoccum	DDK 1001, DDK 1009	-	-	-
Northern Hills Zone (NHZ) *Western Himalayan regions of J&K (except Jammu and Kathua distt.); H.P. (except Una and Paonta Valley); Uttarakhand (except Tarai area); Sikkim and hills of West Bengal and N.E. States*				
Bread wheat	VL 738, VL 804, HS 240	HS 295, HS 420	VL 738, HPW 42, HS 365, VL829, VL832 SKW 196	HS 375(For summer sowing)
Triticale	-	-	DT 46	-
Southern Hills Zone (SHZ) *Hilly areas of Tamil Nadu and Kerala comprising the Nilgiri and Palni hills of southern plateau*				
Bread wheat	HUW 318, HW 1085, HW 2044	-	-	-_



"Rotary Disc Drill" has been developed at the Directorate with an active participation of the Rice-Wheat Consortium for Indo-Gangetic plains, which is capable of seeding under loose residue conditions.

Crop Diversification

Diversification of wheat based cropping system especially rice-wheat system by introducing short duration legume crops for grains or green manuring helps in restoring soil health by enhancing the organic matter content and improving the soil physico-chemical properties. Among various diversified cropping sequences, rice-vegetable peas-wheat rotation gave the highest net return per unit area and it appears to be the best option for maximisation of net returns and sustainability of the rice-wheat system.

Plant Protection Technologies

Indian wheat production has been free from disease epidemics during the last three decades mainly because of systematic deployment of rust resistance gene in HYVs. The survey and surveillance of rust virulence and identification of resistance donors against important diseases and pests were very crucial activities in this direction. Pest risk analysis has been carried out for Karnal bunt to safeguard the national export potential and Integrated Pest Management (IPM) modules have been developed and validated for cost effective and eco-friendly control of pest and diseases of wheat. Efficient protection technologies have also been developed to control aphids and termites.

Challenges ahead

- Stagnating yield potential
- Unavailability of quality seeds and low seed replacement
- Global climate change
- Sustainability of Rice-Wheat System
- Reduced Total Factor Productivity and imbalanced use of fertilisers
- Limited irrigation availability
- Restrictions to germplasm exchange in new IPR regime
- Yield gaps at farm level

Future Strategies for enhanced production

Breaking yield barriers through genetic enhancement

Genetic diversity will continue to be the key factor and new approaches needs to be adopted to enhance yield potential of wheat genotypes. In this regard, the future strategy will be aimed to introgress desirable genes complexes from unexploited germplasm and wild progenitors for creating new variability.

Exploitation of Hybrid Vigour in Wheat

Now the emphasis is on the cytoplasmic genetic male sterility system that needs a good male sterility system, fertility restoration system and the correct combination of the genotypes for higher heterosis. The efforts are in progress to understand the floral biology for enhanced outcrossing, identification of heterotic pools and diversification of male sterility and fertility restoration system that will be helpful in future strategies for hybrid development.

Molecular approach for precision breeding

Molecular mapping of genes, Doubled haploid system, understanding structural and functional genomics of wheat, the transformation approach etc can help in improving the wheat breeding programme.

Tailoring wheat genotypes in cropping system perspective

New resource conservation technologies have been developed for high output from wheat cultivation in a profitable and sustainable manner. This needs to be accomplished with specific genotypes for cultivation under different RCTs.

Improved varieties for abiotic stresses

Breeding for heat tolerance is one of the major issues under prevailing stress environments. The salinity and alkalinity condition is another threat that severely affects productivity of wheat. Genotypes tolerant to waterlogging have been identified which needs to be incorporated in high yielding background.

Disease resistance breeding

The new threats of stripe rust race *78S84* and stem rust race *Ug99* are becoming more dangerous for higher productivity. Although the resistant sources have been

identified in international collaboration, the need is to develop high yielding varieites with resistance to these races. Leaf blight and flag smut, Karnal bunt are other diseases of impotance that needs to be taken care of for wheat production and the exports.

Conservation Agriculture

Conservation agriculture will help to retain the residue on the surface of the soil which will act as biological tillage, conserve the soil moisture, release nutrients to the plant as and when required, reduce soil erosion, keep a check on weeds and provide enabling environment that will ultimately help in sustenance of soil and crop productivity.

Integrated Water, Nutrient & Weed Management

Issues like water conservation, watershed management, sprinkler and drip irrigation and FIRB (Furrow Irrigated Ridge-till and Bed-planting) system of wheat cultivation needs to be addressed with respect to increased nutrients and moisture use efficiency. Attention is also needed for balanced use of chemical fertilizers, use of biofertilizers and other sources for improving soil structure and texture. As most of the area follows the wheat based cropping system, there is a need to focus on integrated weed management and succession of weeds in a cropping sequence.

Diversification / Intercropping/ Companion Cropping

Since area under wheat is not going to expand further, there is a need to evolve suitable genotypes and production technologies for various synergistic and parallel intercropping/ companion-cropping systems. The present efforts to diversify the rice-wheat system need to be enhanced through support from policy makers and extension workers.

Quality Improvement in Wheat

With tremendous human resource and emerging food processing technologies, India has a large scope to develop instant food industries, thus, the Indian wheat programme has to strengthen to meet the quality requirement of domestic and international market.

Post harvest technology

Food processing industries can take maximum benefit from superior varieties of wheat if procurement and processing of grains at market level is attended with special care.

Access to quality seeds of wheat

For quicker replacement of old, susceptible and otherwise uneconomical varieties, the research institutes of the ICAR, SAUs and State Departments of Agriculture should develop a strategy to distribute and popularize newly released cultivars.

Strengthening linkage between research and extension

Transfer of technology through frontline demonstrations will be the major focus to bridge yield gap between experimental field and farmer's field. If the production gaps are bridged, an additional production of 29.4mt wheat under irrigated conditions is possible through existing technologies.

Cooperation from state agricultural extension units and Agricultural Universities would be a key factor in this process.

Developmental and policy Issues

Policy support is needed to popularise and spread ecofriendly production technologies such as Zero tillage and crop diversification, production and marketing of high quality product specific wheat, installation of modern silos to prevent post-harvest loss of quality and quantity of grains and development of wheat based rural industries and cooperatives for producing and marketing value aided products.

Conclusion

The present yield plateau is the major concern for achieving the targeted wheat production of 109mt by 2020. However, bridging the yield gap between experimental and farmers' fields can solve the problem to a considerable extent. With the existing technologies, about 29.4mt wheat can be added to the national basket. For future needs, the genetic enhancements of yield potential through integration of conventional and molecular approaches with special reference to the changing climatic conditions, integrated management of resources and incorporation of resistance genes to various biotic and abiotic stresses are very significant factors. Quality of wheat will continue to be one of the major foci of research. With support from farmers, policy makers and extension units, it is expected that present technologies can be further refined and popularized so that wheat production can be enhanced to meet our future demand for the food and nutritional security.

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Technology intervention in vegetable crops for enhanced production and export

Dr Mathura Rai, Dr AK Pandey and Dr AB Rai

Dr Mathura Rai

Presently, India occupies 7.8 mha with an annual production of 125.89mt in vegetables. Potato ranks first (26.7%) in total production of vegetables followed by other important solanaceous vegetables like brinjal (8.4%) and tomato (8.6%). Onion is one of the most important vegetables, occupying a significant share (8.5%) in vegetable production. Cauliflower and cabbage are the most preferred winter vegetables and their total share in the country's vegetable production is 4.8% and 5.4%, respectively. Other important vegetables, which are primarily grown in the country, are okra, vegetable peas and a good range of cucurbits.

West Bengal ranks first in the total production of vegetables contributing to more than one-fifth of the entire country's vegetable production. Uttar Pradesh, Bihar, Orissa, Tamil Nadu, Gujarat and Karnataka are the other leading vegetable producing states in the country. In last one decade, there has been considerable progress in enhancing the productivity of vegetables which is presently 16.1t/ha. To ensure the nutrition security of the burgeoning population of the country, it is estimated that by 2020, the country's vegetable demand would be around 135mt. To achieve this target, it is *sine qua non* to integrate the various technologies right from production to post-harvest.

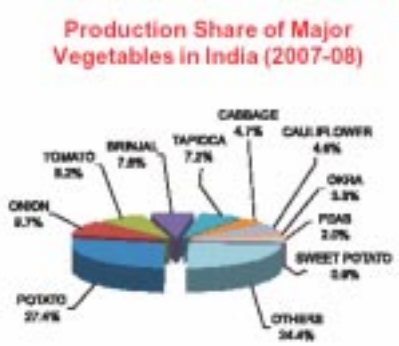
Vegetable hybrid: a novel option for the future

In recent past, much emphasis has been given to exploit heterosis in several economically important vegetable crops like tomato, brinjal, pepper, cabbage, cauliflower, other cole crops, radish, carrot, cucurbits, etc. Vegetable breeders prefer to select hybrid breeding because it is comparatively easy to incorporate the resistant genes for biotic and abiotic stresses in F_1 hybrid. Moreover, under optimum crop production and protection management, crops raised from seeds of F_1 hybrids have several distinct advantages including better yield, adaptability under adverse conditions and ability to resist

Table 1. State wise area, production and productivity of vegetables in the country

STATE/UTS	Area (000ha)	Production (000MT)	Productivity (T/ha)
Andaman & Nicobar	4.3	32.6	7.58
Andhra Pradesh	264.9	4355.9	16.44
Arunachal Pradesh	23.7	110.0	4.64
Assam	328.9	4474.2	13.6
Bihar	823.7	14067.7	17.1
Chandigarh	0.1	1.7	17.00
Chhattisgarh	292.6	2934.3	10.00
D & N Haveli	1.5	13.5	9.00
Daman & Diu	0.2	0.2	1.00
Delhi	42.7	595.6	13.9
Goa	8.5	85.0	10.00
Gujarat	411.7	7402.9	18.00
Haryana	274.6	3277.1	11.90
Himachal Pradesh	63.7	1150.7	18.01
Jammu & Kashmir	58.6	1238.1	21.01
Jharkhand	238.8	3639.7	15.02
Karnataka	406.0	5030.9	12.04
Kerala	166.9	3479.1	20.08
Lakshadweep	0.4	14.0	35.00
Madhya Pradesh	209.3	2919.7	13.90
Maharashtra	455.3	6454.8	14.2
Manipur	12.1	113.7	9.4
Meghalaya	42.5	352.5	8.3
Mizoram	1.3	37.9	30.9
Nagaland	10.38	63.5	6.1
Orissa	660.8	8214.6	12.40
Pondicherry	2.7	54.7	20.6
Punjab	171.7	2772.1	16.1
Rajasthan	135.7	819.9	6.00
Sikkim	20.1	95.9	4.8
Tamil Nadu	262.7	7957.7	30.4
Tripura	33.5	423.5	12.6
Uttar Pradesh	960.9	19790.3	20.6
Uttrakhand	80.6	1036.2	12.9
West Bengal	1313.2	22456.8	17.1
TOTAL	**7803.00**	**125887.00**	**16.1**

Source: NHB Data Book, 2007-08



studies have been undertaken in different parts of the country. The agro climatic conditions prevailing in several parts of north-western Himalayas of J&K, Himachal Pradesh and Kaman and Narwhal division of Uttaranchal are very favourable for growing these exotic vegetables. Besides, they may also be grown during winter season in plains of north India including Punjab, U.P. and Haryana.

several biotic and abiotic stresses along with consumers' preferred quality traits.

Development of hybrids through AICRP

ICAR had initiated a network project entitled, "Promotion of Hybrid Research in Vegetable Crops" during 1995-96. This project was initiated in nine vegetables, viz., tomato, brinjal, chilli, capsicum, okra, onion, cabbage, cucumber and bitter gourd with the objectives (i) to promote hybrid research (ii) to incorporate biotic stress resistance in the hybrids, (iii) to strengthen hybrid seed research and hybrid seed production technology (iv) to test the proven hybrids for their potentiality and (v) to establish their production technology. Based on critical review of the achievements of this project, a mission mode project is under operation with financial support from National Agricultural Technology Project (NATP). This project was aimed at hybrid research especially on the development of specific quality hybrids of tomato, brinjal, chilli and onion at twelve centres. Several promising hybrids have been developed through the project, which are currently being tested in multi locations.

Tapping the export potential of exotic vegetables

Recently few exotic vegetables including broccoli, red cabbage, Savoy cabbage, Chinese cabbage, celery, leek, parsley have been introduced and their adaptability

Table 2. Hybrids of vegetables recommended for release and cultivation through AICRP

Crop	Name of identified hybrids
Tomato	ARTH-4, MTH-6, ARTH-3, Pusa Hybrid-2, FMH-2 (A. Vardhan), NA-501, DTH-4, KT-4, NA-601, FMH-2, BSS-20, Avinash-2, HOE-303, Sun-496, BSS-20, DTH-8, Swarn Baibhav (CHTH-1), ARTH-128, KTH-2
Brinjal	Arka Navneet, Kat-4, Pusa Hybrid-6, Pusa Hybrid-5, ARBH-201, NDBH-1, ABH-1, MHB-10, MHB-39, NDBH-6, ABH-2, ABH-2 , Phule Hybrid-2, Pusa Hybrid-9, ARBH-541, PBH-6, JBH-1, BH-1, BH-2, Kashi Sandesh
Chilli	HOE-888, ARCH-236, Sungro-86-235, ARCH-228, CCH-2, CCH-3
Capsicum	KT-1, SEL-II , Lario, DARL-202
Okra	DVR-1, DVR-2, DVR-3, DVR-4
Cauliflower	Pusa Hybrid-1, DCH-541; Synthetic variety: Synthetic-1, Early Synthetic
Cabbage	Shri Ganesh Gol, Nath-401, BSS-32, Nath-501, Quisto; Synthetics: Pusa Synthetic
Carrot	Hybrid-1
Muskmelon	Hybrid M-3, MHY-5
Watermelon	Arka Jyoti
Bitter gourd	Pusa Hybrid-2
Cucumber	PCUCH-1
Bottle gourd	PBOG-2, PBOG-1, NDBH-4

Cultivation of celery and parsley were started during 1990s under controlled conditions at very small extent in Chatarpur near Mahrauli in Delhi and Kairana in Muzaffarnagar by rich farmers to cater to Delhi, Mumbai and Kolkata markets. Few multinational companies have also started processing a few exotic vegetables. As the demand of exotic vegetable are increasing owing to the awareness and living standard, cultivation of these vegetables will provide employment, boost the income of growers apart from the diversity in food basket and nutritional security.

Vegetable seed production-a highly profitable laced venture

The hybrid vegetable seed industry in India is estimated at Rs.180 crore. India is the second largest user of hybrid tomato seeds after USA. Cabbage and tomato have the largest area under hybrids 40% and 35% of their total area, respectively. Hybrid seed production technology can be taken as a very remunerative venture by small and marginal farmers. Approximately 40 farmers in Punjab are producing hybrid seeds of chilli, CH 1 and CH 3 using a male sterile gene (ms-10) introduced from France. Similarly, seeds of Punjab hybrid muskmelon are also being produced by the farmers using male sterile line (ms-1).

Contract farming of vegetables

With the emergence of the free market economy in the wake of

Table 3. Crop-wise states identified for certified foundation/certified seed production

Crop	States / Organizations
Beans	Andhra Pradesh, Karnataka, Tamil Nadu
Bhindi	Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Orissa, Punjab, Tamil Nadu, Uttar Pradesh
Bitter gourd	Andhra Pradesh, Karnataka, Maharashtra, Uttar Pradesh, West Bengal
Bottle gourd	Andhra Pradesh, Karnataka, Maharashtra, Uttar Pradesh
Brinjal	Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh
Cabbage	Assam, Himachal Pradesh, Jammu & Kashmir
Capsicum	Himachal Pradesh, Karnataka, Maharashtra, Sikkim, Uttar Pradesh
Carrot	Haryana, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttar Pradesh
Cauliflower	Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Rajasthan, Uttar Pradesh
Chillies	Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh
Cucumber	Andhra Pradesh, Uttar Pradesh
Luffa	Andhra Pradesh, Maharashtra, Uttar Pradesh
Methi	Haryana, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttar Pradesh
Onion	Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh
Palak	Bihar, Haryana, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh
Peas	Haryana, Himachal Pradesh, Madhya Pradesh, Rajasthan, Uttar Pradesh
Pumpkin	Andhra Pradesh, Karnataka, Maharashtra
Radish	Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh
Tomato	Andhra Pradesh, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh
Turnip	Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh

liberalization, globalization, privatization and the fast expansion of agri-business, small farmers may find difficult to cope with the volatility in the economy. They tend to be marginalized and migration from rural to urban areas is increasing alarmingly all over the country. As a result, consolidation of holdings is increasingly becoming the need of the day. Therefore, the need of the hour is to mitigate the difficulties in the contract farming system, which would hopefully popularize it further among small farmers

The success story of Pepsi Foods ltd.

Launching its agro-business in India with special focus on exports of value-added processed foods, Pepsi Foods Ltd. ('PepsiCo' hereafter) entered India in 1989 by installing Rs.22 crore state-of-the-art tomato processing plant at Zahura in Hoshiarpur district of Punjab. The company intended to produce aseptically packed pastes and purees for the international market. However, before long, the company recognized that investment in agro-processing plants would not be viable unless the yields and quality of agricultural produce to be processed were up to international standards. At that point of time, tomato had never been cultivated in Punjab for its solid content, with a focus on high yields and other desirable processing characteristics such as colour, viscosity and water binding properties. This led to the birth of PepsiCo's backward linkage with farmers of Punjab in form of contract farming.

Exports is driving organic food production in India

The increasing demand for organic food products in the developed countries and the extensive support by the Indian government coupled with its focus on agri-exports are the drivers for the Indian organic food industry. APEDA (Agricultural and Processed Food Export Development Authority) coordinates the export of organic food (and other food products) in India. The National Programme for Organic Production in India was initiated by the Ministry of Commerce. The programme provides standards for the organic food industry in the country. Since these standards have been developed taking into consideration international organic production standards such as CODEX and IFOAM, Indian organic food products are being accepted in the US and European markets.

Organic food products exported from India include the following:

- **Organic Cereals:** Wheat, rice, maize
- **Organic Pulses:** Red gram,

Table 4. Export of vegetables (QTY in MT value in Lakh)

	2006-2007		2007-2008	
	Qty	Value	Qty	Value
Floriculture & seeds				
Floriculture	42545.28	65269.73	36240.71	34014.42
Fruit and vegetable seeds	8104.09	12158.95	10157.13	14212.29
Total for Floriculture & seeds	**50649.37**	**77428.68**	**46397.84**	**48226.71**
Fruits & vegetables				
Fresh onions	1378373.17	116330.57	1008606.48	103577.89
Other fresh vegetables	276824.6	43314.38	350235.47	48949.01
Dried nuts (walnuts)	5062.86	11803.79	6716.48	16207.8
Fresh mangoes	79060.88	14193.95	54350.8	12741.76
Fresh grapes	85897.79	30192.45	96963.57	31782.51
Other fresh fruits	177638.02	30997.3	207700.78	30452.6
Total for Fruits & Veg.	**2002857.32**	**246832.44**	**1724573.58**	**243711.57**
Processed fruits & vegetables				
Dried and preserved vegetables	119270.43	42754.17	125726.28	42993.81
Mango pulp	156835.51	50582.79	166752.17	50968.51
Pickle and chutney	145216	29359.48	127558.47	25061.71
Other processed fruits and vegetables	172851.58	66191.34	184197.82	71219.94
Pulses	255084.47	78999.4	170614.39	54900.85
Total for Processed Fruits & Veg	**849257.99**	**267887.18**	**774849.13**	**245144.82**

black gram

- **Organic Fruits**: Banana, mango, orange, pineapple, passion fruit, cashew nut, walnut
- **Organic Oil Seeds and Oils:** Soybean, sunflower, mustard, cotton seed, groundnut, castor
- **Organic Vegetables:** Brinjal, garlic, potato, tomato, onion
- **Organic Herbs and Spices:** Chilli, peppermint, cardamom, turmeric, black pepper, white pepper, aonla, tamarind, ginger, vanilla, clove, cinnamon, nutmeg, mace,
- **Others:** Jaggery, sugar, tea, coffee, cotton, textiles

Under the "National Project on Organic Farming" for production, promotion and market development of organic farming in the country, financial assistance is provided for capacity building through service providers, setting up of organic input production units, promotion of organic farming through training programmes, field demonstrations, setting up model organic farms and market development. Under the "National Horticulture Mission" (NHM) and "Technology Mission for Integrated Development of Horticulture in North Eastern States, J&K, Himachal Pradesh and Uttarakhand" promotion of organic farming has been included as a component and financial assistance is provided for organic cultivation of horticultural crops, setting up of vermi-compost units and organic farming certification.

GAP for organic farming of vegetables

GAP (Good Agricultural Practices) can not only minimize the expenditure on escalating cost of production but may prove boon for organic farming also. Common agronomic practices should be suitably modified to make uncongenial condition for pests and to enhance the activity of natural enemies. Keeping in mind the diversity and intensity of pests in particular place, selection of resistant / less susceptible varieties, holds good in pest management. Plant resistance provides a built in ability to allow less pest and cut off the extra load of insecticides in the crop. Being completely safe, host plant resistance fits well with all other components.

Vegetable export- present status

India's export of fresh vegetable during 2007-08 was around 484.49crore rupees. during 2007-08, substantial progress has been made in export of dried and preserved vegetables which was to the tune of Rs.429.93crore. Details of export of various commodities related to vegetables and their processed products are given below.

Minimal processing of vegetables

Minimal processing is an emerging technological concept which had gained much popularity in the recent past. Technology enables global marketing of pre cut vegetables and fruits in pre packaged form and the products are meant for specific end use *viz.,* curries, salad, pies, stuffing, topping and garnishing. A part from offering fresh/fresh like vegetable products, minimal processing also results in elimination of kitchen drudgery with significant convenience and restriction in packaging and transport costs. The minimal process involves sanitation wash, physio-chemical conditioning of the tissue followed by prepackaging in flexible pouches. The technology is less capital intensive with low energy consumption and requirements of technical manpower making it suitable for rural based industries.

Recent export promotion measures

Some of the major ones are (i) New Foreign Trade Policy (FTP). Under the new FTP (2004-09) announced by the Ministry of Commerce & Industry, Government of India, a host of incentives have been given to boost agri-exports. These *inter alia* include (a) duty-free import of capital goods under the Export Promotion Capital Goods (EPCG) scheme, (b) Duty credit scrip equivalent to 5% of the f.o.b. value of exports, and the (c) Launching of Vishesh Krishi Upaj Yojana which is aimed at promoting agri-exports, viz. vegetables, fruits, flowers, minor forest produce, etc. (ii) Setting Up of JV. The world trade organization (WTO) and General Agreement on Tariffs and Trade (GATT) has opened the new opportunities for the country to compete at the global level for exporting fresh and processed vegetables. Accordingly, India is emerging as one of the major exporting countries for a number of vegetable crops.

Director, Indian Institute of Vegetable Research, Varanasi

Industry

Fertilizers

Past, Present and Future

It was a great Indian dream in the 50's to attain self sufficiency in food production which appeared to be a mirage considering the prevailing food production at that point of time. The story of PL 480 funds and the whiplash India faced when it tried expressing itself against USA in the UN, is well remembered. Infact it took the earnest wish of Lb Johnsons' daughter, to restart supplies of wheat to the starving India. It took the pioneering efforts of Dr M S Swaminathan, Sri C Subramanian, Dr Norman Borlaug to introduce short duration Mexican varieties of wheat to usher in what is today popularly called "GREEN REVOLUTION". Production, breeding of hybrid varieties soon became an infectious passion amongst Indian scientists and break throughs were emerging in many areas like production of milk, oil, fish etc and new revolutions like white, yellow, blue revolutions came to stay.

India was adding every year one Australia, thereby putting pressure innocuously on the Indian soil. Since high yielding seed varieties were more hungry for nutrition, demand for nutrition increased. This demand was growing at a creeping rate of 4 to 5 % per annum and was being silently but effectively fuelled by the artificially controlled pricing, Indian farmers were enjoying. Without a doubt, India was getting into a trap from which it would find it difficult to extricate.

The demand for nutrients in the form of Urea, DAP, NPKs, MOP started going up, from 55,000 MT in 1950 to 25.3 million MT in 2009. The Indian fertilizer industry had arrived on the international scene, supported substantially through the retention pricing system and the partial decontrolled *ad hoc* subsidy route.

India became the world's second largest consumer of fertilizers, but in the same way it also started consuming subsidy amounting between Rs.50,000 to Rs.117000 crore, per annum which has become a burden beyond bearing.

India produces 20 million MT of urea largely using indigenous natural gas, and simultaneously imports 6 to 7 million MT, to meet the demand, wherein the price of urea that farmers pay is cheaper than the price of common salt. Possibly this has addicted the farmer to injudiciously, broadcasting urea, resulting in poor productivity of almost all crops grown in India.

Dr G Raviprasad

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Reluctance on the part of the political system ensured continuation of the suppressed prices to farmers which also assured international suppliers that India will buy, whatever the price is quoted as there is no viable alternative. The situation has become grave as food production can drop substantially, if fertilizer consumption is restricted, and when India, initiates efforts to import food grains, it becomes a suppliers paradise, with prices of wheat, pulses and oilseeds skyrocketing.

Rationalizing the subsidy through the nutrient based policy has been given a thought, while simultaneously looking at methods of direct disbursal of a subsidy amount of nearly Rs. 50000 cr to 12 crore farmer households.

Many variants have assumed serious proportions and they are increasing subsidy, stagnated food production, new methods of subsidy disbursal, which will have an

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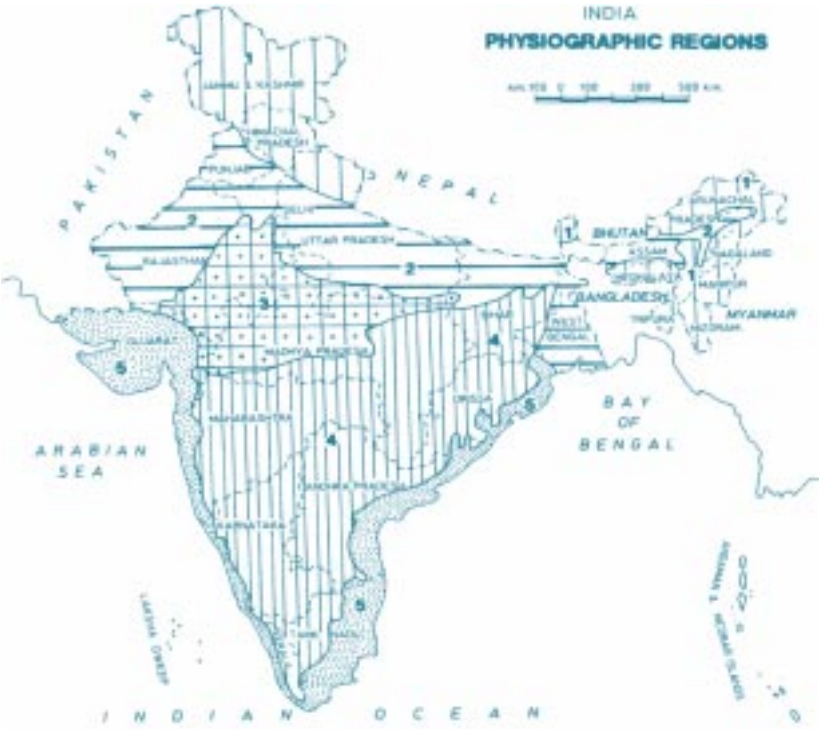


impact on food availability and fiscal deficit. We do not have a tablet to get rid of all these head aches at a time, but certainly have a route plan to mitigate the pain.

Firstly excessive use of urea has to be curbed by increasing the prices, so that injudicious use is restricted. The same price increase, though moderate should be applied for other fertilisers immediately.

The fertilizer control order should accommodate more grades or varieties of fertilizers, so that the Indian farmer has a choice, to use low, medium and high grades appropriately.

Thirdly, fortification with micronutrients as well as using large quantities of good quality micronutrients, water soluble fertilizers, should be encouraged. Introduction of modern high yielding varieties/ hybrids of rice, wheat, maize, sorghum and pearl millet coupled with application of high doses of NPK fertilizers resulted in increased production which in turn is triggering removal of micronutrients from the soil. Profuse and increased use of high analysis Di-Ammonium phosphate (DAP) over single superphosphate (SSP) and almost nil application of farmyard/organic manures has resulted in the wide spread deficiencies of soil micronutrients in India.

Proper methods of application *i.e.,* Band Placement, Fertigation and Foliar application of fertilizers are more efficient methods of application compared to broadcasting. The recovery of nutrients in fertilizers is usually increased when the material is placed near the seed, e.g. by band placement. Water Soluble fertilizers for application through foliar or drip irrigation needs to be promoted intensively.

Soil Organic carbon(SOC) con-

Symbol	Region	SOC(Pg) 0-30 cm	Area (M Ha)
1	Northern Mountains	7.89 (39%)	55.3 (17%)
2	The Great Plains	3.28 (18%)	72.4 (22%)
3	Peninsular India	3.64 (17%)	54.7 (17%)
4	Peninsular Plateau	3.62 (17%)	105.7 (32%)
5	Coastal Plains and the Islands	2.24 (11%)	40.9 (12%)

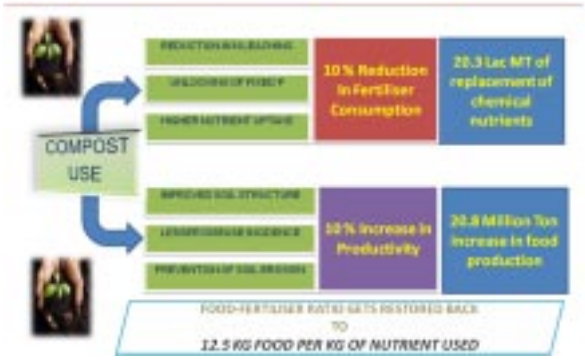
tent levels of Indian soils are to be expressly augmented by encouraging use of compost, which is subsidized appropriately.

Alternate sources of plant nutrition need to be explored and exploited to strengthen our position in global markets. Options like MSW composting require increased impetus from GOI and favourable policies need to be designed to encourage waste composting initiatives in India.

Mumbai alone generates 7,000 tonnes of garbage a day, which could fill a one square kilometer (100 Ha) pit up to 20 feet deep every year. Same 100 hectares of land otherwise could have been used sufficiently to build 1 Lac houses giving shelter to nearly 4 Lakh people. Same garbage could be successfully composted to enhance productivity of 10 Lakh acres of adjoining hinterland.

The entire country should undertake soil analysis and mapping, through digital process for macro and micronutrients. Most efficient way of supplying nutrients is to supply only as much nutrient as required by the plant at its growth stage. Thus SOIL TESTING becomes the first step to know the requirements of additional fertilizer application. Although in India, number of soil sample being tested is increasing every year, but biggest concern is the time lag between date of sampling and date of receipt of report which in most of the cases is so long that it misses the mark. Lot of work still needs to be done on prompt diagnosis techniques like Soil Chromatotogram and other rapid reporting technologies to realize the potential of soil testing tool.

State and university recommendations for integrated nutrient management should consider new products as well as measures to enhance use efficiency of existing fertilizers. The efficient use of fertilizers is important for three main reasons. First, raw materials reserves like phosphate rock, from which fertilizers are manufactured, are fi-



nite, nonrenewable resource, and must be used efficiently in order to maximize their life span. Second, there is a need to maintain and improve the nutrient status of many soils for the growth of crops for food, fiber and bio-energy. This is particularly important in least-developed countries (LDCs) like India that need to increase food production and improve rural livelihoods. Third, the transfer of soil nutrients (derived from fertilizers and organic manures) is a major cause of environment deteriorations like P-induced eutrophication in surface waters and nitrate pollution which is 200 times more harmful than CO_2 emissions.

Use of information technology for crop diagnostics, symptom analysis, and transfer of information should also be given emphasis.

Indian agriculture is at cross roads and can be corrected, gradually if the intent and resolve is exhibited. With current levels of consumption of 25 million MT of chemical fertilizers, India should be producing at least 300 million MT of food grains, which is a modest estimate of productivity and can exceed 330million MT if productivity is good and can cross 350 million MT if Indian agriculture productivity is very good, reaching 375 million MT at excellent levels of productivity,

The objective of the Indian fertilizer industry is to increase food grain production and improve the productivity levels. Subsidy is an instrument to aid in maximizing production. The Indian fertilizer industry must aim through multi pronged strategies as listed below to improve production and productivity.

First and foremost, the industry with support from the Govt of India, must seriously secure the raw materials for consistent production of phosphatics as well as nitrogenous fertilizers. New areas of rock phosphate mining, potash mining must be secured on similar lines, as is being done by the oil industry, by competitive bidding of blocks. New rock phosphate producing countries like Tunisia, Australia, Polynesian islands, Uganda etc., must be scouted and long term contracts signed as a first step into backward integration.

Potash mines in former Soviet Union, Thailand, Jordan must be explored and mining rights secured. In fact, China has been a pioneer in this area and India must emulate this option. Natural gas which is now being made available by Reliance Industries should be exploited fully and India's Urea/Ammonia production should increase substantially. India now must look at beneficiation of low grade rock phosphate available in Rajasthan and Madhya Pradesh and improve the concentration of low grade rock, so that it is available for manufacture of Phosphoric Acid. Sick fertilizer plants in India, pending revival or disinvestment, must be handed over to good fertilizer units on tolling basis and thereby kick start production and employment.

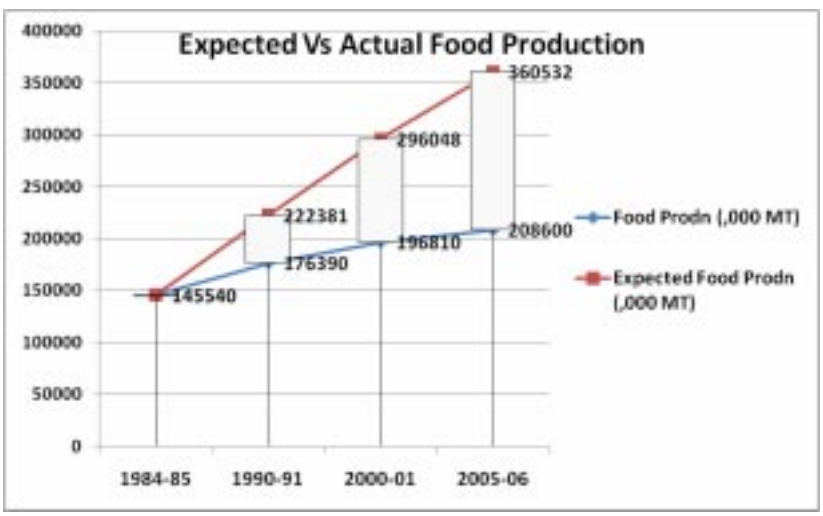
Usage of micronutrients and organic compost as explained earlier will reduce the consumption of chemical fertilizers, while simultaneously saving subsidy and increasing food yield.

Through the process of judicious usage of fertilizers, if 20 lakh MTs of fertilizers, consumption is saved, it will amount to a saving of RS. ten thousand crore.

This amount of Rs.10,000 crore can be set aside for improved mechanization of agriculture. Two lakh tractors per annum can be subsidized and used for mechanical application like ploughing, winnowing etc., and simultaneously create 2 to 3 lakh jobs for educating unemployed youth.

India and Indian fertilizer industry should search methods to reduce fertilizer subsidy which eventually find its way into the coffers of overseas supplies who continue to exploit the Indian industry.

It is possible for India to emerge as the world's food supermarket, if it shows the resolve as India is the only country in the world with such ecological and crop diversity, blessed with long hours of sunshine, excellent irrigation, intelligent scientists, productive factories and hardworking farmers.



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The Seed that Changed the Face of Indian Agriculture: Contributions of the Public Research Institutions

Dr HS Gupta, Dr Malavika Dadlani and Dr KV Prabhu

Dr HS Gupta

Genetic enhancement was the main technological intervention effected through the NARS that enabled the sustained Green Revolution to happen in India, unlike many other countries, where the same original seed source was supplied at the same time. This was made possible due to the development of improved crop varieties, using diverse plant genetic resources and combining the conventional and modern breeding technologies, in conjunction with adequate use of irrigation and fertilizers, followed by the establishment of a well-organized seed sector. It is estimated that the direct contribution of quality seeds alone to the total production is nearly 15-20%, which can be further raised upto 45% with efficient management of other inputs. Hence, concerted efforts are made by the NARS in strengthening the seed sector of the country through

- development and release of improved crop varieties to suit the needs of different agro-climatic conditions, particularly the less favourable environments.
- production of sufficient quantities of high quality Breeder Seed of these varieties
- horizontal spread of new varieties and quality seeds through farmers' participatory approach
- training farmers to undertake seed production for supporting the seed sectors

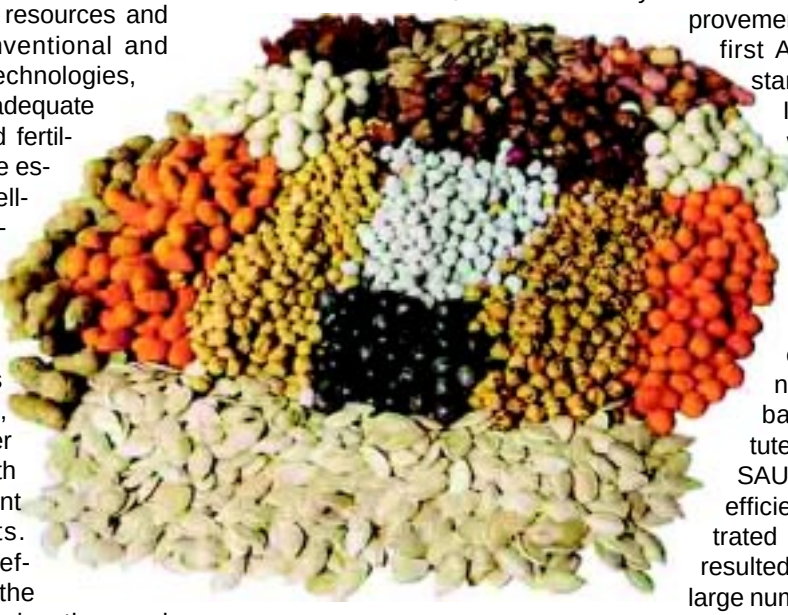


Table 1. Number of Notified Varieties of Agriculture Crops from 1969-2009

Crop Group	Varieties Notified
Cereals	1333
Fiber Crop	385
Forage Crop	162
Millets	1060
Narcotics (Other Crops)	8
Oilseed	884
Pulses	891
Sugar Crops	70
Grand Total	**4793**

Crop Improvement & Release of New Varieties

The system known as All India Coordinated Research Project on various crops (AICRP), which functions through a sound scientific analyses of the multi-location yield trials supported by a series of unbiased evaluations carried out by NARS partners for all involved ancillary and supportive data ranging from agronomic situations, physiological manifestations, quality parameters and pest & disease nurseries. This model has gained global recognition and is being adopted by the international crop variety improvement programmes. The first AICRP (Maize) was started at IARI by the ICAR in 1957, which was followed by many more in the 60's and 70's, covering all major field crops.

This was further strengthened by the establishment of a number of ICAR crop based research institutes on one hand and SAUs on the other. The efficient and well-orchestrated efforts of the NARS resulted in the release of a large number of varieties in all major field crops, vegetables and

Table 2. Number of Notified Varieties of Horticulture Crops from 1969-2009

Crop Group	Varieties Notified
Bulb Vegetables	38
Cash Crops	3
Cole Crops	47
Cucurbits	117
Flower Crops	4
Fruit Crops	9
Fruit vegetables	222
Green leafy vegetables	27
Medicinal and Aromatic Crops	1
Root vegetables	38
Tubers and Rhizomes	50
Grand Total	556

horticultural species.

The Government of India formally associated in these seed building exercise by enacting the Seed Act (1976) that set up the standards and mode of notifying varieties suitable for cultivation in different parts of the country facilitating their seed production through the channels of Breeders' Seed, Foundation Seed and Certified Seed. The Government also facilitated through this act the establishment of seed producing agencies such as National Seed Corporation, State Farms Corporation of India, etc., and supported the State Governments to establish their own Seed Development Departments and Seed Certifcation Departments in addition to seed production departments. Thus the "Seed Chain" envisaged by scientific breeding procedures were supported by an infrastructure within the public sector that enabled "quality seed" standardization as well as production to help farmers access the improved varietal seed. By 2009, more than 4,500 field crop varieties and more than 500 varieties of horticultural crops were released and notified by the DAC, Ministry of Agriculture, Govt. of India. In addition to these, the SAUs and ICAR institutes have also released a good number of varieties for state release and notification. This has been the backbone of Indian agriculture and laid the foundation for a strong seed supply system in the country.

Fig 1. Notified varieties in India from 1969 - 2009

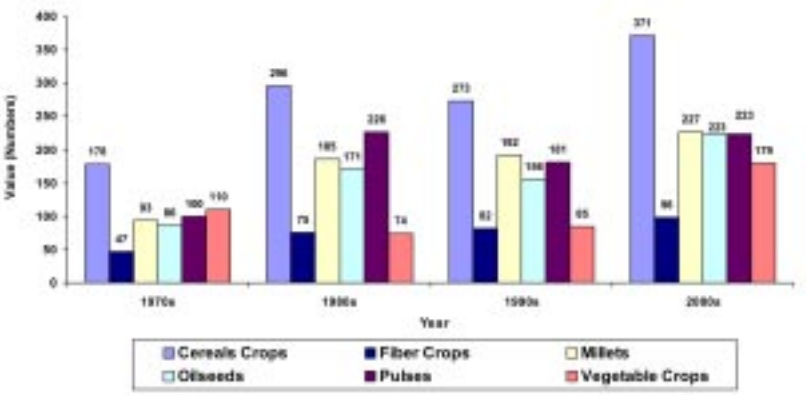
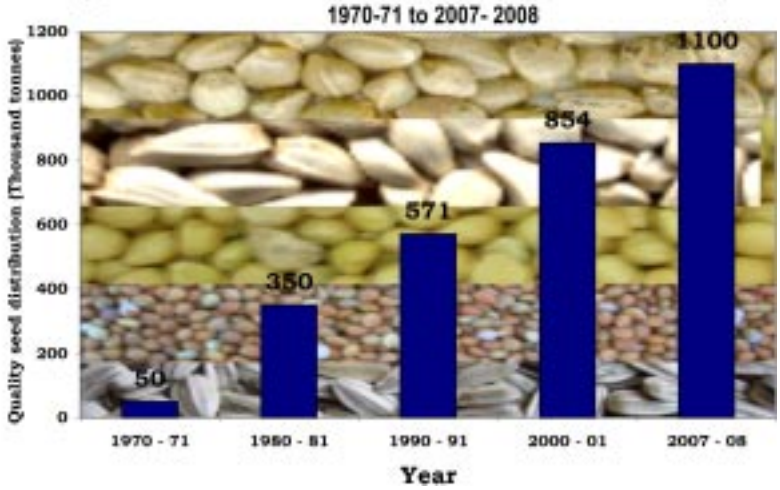


Figure 2. An overview of Quality seeds ditribution in India over the year 1970-71 to 2007- 2008



Present Status of Seed Availability

Currently, the global seed market is valued at Rs.1, 36, 000 crores ($ 34 billion), of which the share of Indian seed industry is valued around only Rs.5200 crores ($ 1300 million) *i.e.,* a meager 4%. In India, hybrid seed market of important field crops *viz.,* cotton, maize, paddy, jowar, bajra, sunflower *etc.,* plays a vital role, which contribute maximum share of 66.2% in value to the total seed market, whereas open pollinated varieties of crops and vegetable account for about 22.3% and 11.5%, respectively.

On the basis of the minimum seed replacement rate of 25% for self – pollinated crops, 35% for cross pollinated crops and 100% for hybrids, it is estimated that the

Table 3. Present status of breeder production of major crops

Crop	2005- 06 Indent	Prod. 2004-05	2006 – 07 Indent	Prod. 2005-06	2007-08 Indent	Prod. 2006-07
Cereals	11417.1	17360.4	13720.5	20032.5	16816.9	20413.9
Pulses	4964.9	7255.9	5365.8	6906.7	7374.3	9137.9
Oil seeds	13152.4	19879.6	15509.6	21673.5	21828.0	23775.6
Fibre crops	108.8	173.9	186.6	435.7	69.9	216.0
Fodder	302.5	371. 1	343.1	424.2	589.2	1213.8
Vegetable	276.5	394.6	141.6	234.7	304.9	403.3
Potato	21565.0	21020.0	17067.0	18947.0	17299.0	18669.0

Source : DAC. Govt. of India

Table 4. Present scenario of vegetable seed production in India

Crop	Requirement (tons)	Production from organized sector (tons)	Other quality seeds (tons)	Seed shortage (tons)
Tomato	360	190	80	90
Brinjal	465	85	50	330
Chilli	200	68	80	52
Cauliflower	280	130	35	115
Cucumber	70	37	20	13
Muskmelon	110	37	40	33
Watermelon	320	135	100	95
Bottlegourd	615	105	100	410
Onion	1200	200	400	600
Okra	4250	1350	800	2200
Radish	650	300	200	150
Carrot	700	200	250	250
Beet root	400	100	120	180
Peas	6000	1500	2000	2500
Cabbage	200	80	60	60
Total	**15820**	**4517**	**4335**	**6968**

Source : DAC. Govt. of India

quality seed requirement of the country is ~ 254 lakh quintal. The requirement of seeds of major crops in India and availability of certified seeds as in 2006 -07 for cereal, pulses, oilseeds and fibre crops exhibited a gap of 50.79, 10.42, 11.26 and 1.31 lakh quintals respectively. Based on the trend in breeder seed produced and made available against indents from 2005-06 to 2007-08, it is expected that the seed requirement for different field crops should be fulfilled in the next five years, assuming normal seed rates. In vegetable crops, total quality seed produced from organized and other sector is estimated to be 8,852t as against the requirement of 15,820t, and there is roughly 45% shortage in the seed requirement. With respect to horticulture crops, those that are vegetatively propagated like banana, grapes, mango litchi, etc., the quality planting materials required are likely to increase manifold in the country by the year 2011–2012, and has been estimated at 1622.3 millions. The public sector needs to play a bigger role in these segments.

Role of the Public Seed Sector

Indian public seed sector constitutes big agencies like NSC, State Farm Corporations of India (SFCI) and 15 State Seed Corporations (SSC). These corporations produce and market seeds of the plant varieties bred by the public sector institutions *i.e.,* the research institutes financed by the ICAR and the SAUs. The public sector research to develop new varieties as well as Nucleus and Breeder Seed production is looked after by public research institutions, under the aegis of ICAR and SAUs. The SAUs also facilitate the quality seed production of the state released varieties. Nucleus seed from the respective breeder or authentic source is used for the production of Breeder Seed. Indents for Breeder Seed are placed by the state governments to the DAC, Government of India, which passes it onto the respective institutions under NARS, through ICAR. Breeder seed production, as per DAC indent, is the mandate of the ICAR. The Breeder Seed produced is allocated by the DAC to the indenters, who should use it for the production of Foundation and eventually Certified seeds. In case of hybrids, the seed of parental lines is produced as Breeder Seed by ICAR/SAU's system which is made available to seed agencies for production of Foundation and then hybrid seed of Certified class. In order to strengthen the seed supply chain, ICAR introduced a Mega Seed Project on "Production of Agricultural Crops and Fisheries" in 2006.

There has been a steady increase in breeder production of all

Table 5. Farmers' participatory quality seed production programmes of ICAR- SAUs

First year	Second year	Third year	Fourth year
Selection of village Training of farmers	50% seed purchased and distributed by SAU as TL seed	50% seed purchased and distributed by SAU as TL seed	50% seed purchased and distributed by SAU as TL seed
Supply of quality seed* by SAU on Credit/ Exchange basis	50% seed exchanged among farmers	50% seed exchanged among farmers	50% seed exchanged among farmers
Monitoring** , On-farm Training and Farmers Fair			FLDs of newly notified varieties

**** Breeder /Foundation/Certified/Test Stock seed***

***** Regular visits of Crop Specialists for monitoring and training***

Source : DAC, 2008; Report on State Seed Corporation

important crops over the years 2005 – 06 to 2007-08. It may be seen that there has been most significant increase in pulses, oilseeds & fodder crops, which have been recording the lowest average SRR in the previous years.

Vegetable Seed Production

According to an estimate, the total overall requirement of vegetable seeds is about 15820t (excluding potato), which is expected to reach 68000t by 2020. Most of the popular vegetable hybrids and varieties, grown in the country are from the private sector. Though the public research institutions have released some excellent vegetable varieties, their share in the market is small as compared to field crops. This is one area, where small farmers can benefit by becoming seed producers / entrepreneurs.

Farmers Participatory Seed Production

Since the use of farm-saved seed in the country, is estimated to be ~70%, there is need to improve the quality of farmers' produced seed, particularly in the low value, large volume segment of nationally important crops such as cereals, pulses and oilseeds, where OPVs still rule the scene. Farmers' participatory seed production programme has shown the potential to spread new varieties and also enhance the quality of farm saved seed used by majority of the farmers in all parts of the country. This mechanism is also supported by the acts connected to seed production, the Seed Act 1976 and PVPFRA (2001) wherein the farmer is legitimately entitled to produce seed of a variety and sell it, distribute it and popularize it. Thus, the introduction of new improved crop varieties through this programme would help their quick spread on farmers' fields and the further multiplication of farmers' accepted varieties would retain them for longer periods to harvest their economic benefits. Further, this programme enables to develop Scientists-Farmers relationship, thus resulting in efficient transfer and implementation of new technologies, including IPM strategies, production technologies and conservation practices and enables a mechanism of feedback of new problems to initiate meaningful research.

Farmers' participatory seed production has been an important mode in both the public and private sectors, mainly through contract farmers, who are the primary seed producers. In the present era, efforts are being reinvigorated both by the schemes introduced by the Central and State Governments. Certified Seed production activities undertaken by the farmers' cooperative societies and groups are also provided with financial support by the Govt. of India in the form of subsidies and bank loans for the production, processing, transport and storage facility development. These efforts are expected to organize the informal seed supply system, which caters to nearly 75% of the total seed requirement in the country and also provides a means to develop a viable enterprise enhancing rural employment opportunities.

Under the Mega Seed Project of ICAR, several models have emerged for quality seed production by the SAUs through farmers' participation. An average of 1 lakh quintal of truthfully labeled (TL) seed of field crops, vegetables and horticulture spp. is annually produced through farmers' participation in 75 centres located at ICAR institutes and SAUs.

Prominent among these are UAS, Dharwad and JNKVV, Jabalpur, who have set records in quality seed production. The partnership programme of IARI not only has resulted in an average additional annual production of about 2,500q of wheat, 3,000q of rice, 80q of pulses and 100q of mustard seed by the farmers, but also proved to be an efficient way of popularizing new improved varieties, thus increasing the Variety Replacement Rate (VRR) along with SRR.

A major impact of this exercise is a double advantaged output from rural farm sector on national agriculture. The first advantage is direct, where the entire region of the village witnesses the singular value addition to a crop produce by having uniform growth and purity. The second advantage is the confidence that gets built in those farmers who produced the seed for becoming small scale industrialists.

In order to spread the new improved varieties in the shortest possible time, partnership between the public research institutes and private/public sector seed companies will be a mutually beneficial step. It is amply demonstrated by the wide spread cultivation of rice hybrid PRH-10 within 3 years, following IARI's collaboration/ partnerships with IFSAA and 15 seed producing companies, both in private and public sectors for Foundation and Certified/TL seed production, respectively.

Director, Indian Agricultural Research Institute, New Delhi

Micro Irrigation
Way to judicious water use

India's gamble with monsoon has always rendered the country with uncertain food grain production. With India's population to catapult to a gigantic figure of 1.63 billion by 2050, it rests upon the shoulders of the country's dwindling land resources to cater to the food demand of the surging human race. This requires a mammoth effort from the food producing machinery of the country - an effort which has to be inclusive of the technological innovation in this field and to the fullest possible extent. Unfortunately, most of the farmers in this country are still reliant on the whims and fancies of the monsoon to salvage their crops. Water being a critical input in raising crops can influence yield and other agronomic conditions to a good extent. Though the conditions have changed with the adoption of high yielding varieties and hybrids which are input intensive, majority of the farming tracts haven't still espoused an organized irrigation system.

India accounts for 16% of the world human population and 30% of the cattle and the country is endowed with just 4% of water resources. Out of the total water resources available, only around 3 % goes in to irrigation and a major portion to public supply. There are also competing demands from industry, livestock, domestic consumption, commercial and other purposes. So even if full irrigation potential is exploited, about 50% of the country's cultivated area will still remain unirrigated. The future is also not going to be any different. The share of water for agriculture would reduce further with increasing demand from other sectors. Although the demand for water in agriculture sector is estimated to increase during the period 2010 to 2050, the share of water for agriculture is expected to reduce from the present level of 85% to 71% by 2050.

Water becoming a resource in distress, efforts should be directed to manage the available water resources effectively

According to research done by the International Water Management Institute (IWMI), one-third of the world's population will face absolute water scarcity by the year 2025. Among the worst hit will be regions in Asia, the Middle-East and Sub-Saharan Africa, home to some of the largest concentrations of rural poverty in the world. This is sending a distress signal to the millions in the farming community as they will have to make suitable interventions to manage this scant resource effectively.

Micro irrigation technologies can provide a reasonable solution to this emerging threat. These technologies can improve productivity; raise incomes through crop yields and outputs and enhance food security of households. Numerous studies

Water Requirement for Various Sectors

Sector	Water Demand in km3 (or bcm)					
	Standing Sub- Committee of MoWR			NCIWRD		
	2010	2025	2050	2010	2025	2050
Irrigation	688	910	1072	557	611	807
Drinking water	56	73	102	43	62	111
Industry	12	23	63	37	67	81
Energy	5	15	130	19	33	70
Others	52	72	80	54	70	111

Some of the major players in micro irrigation in India with their estimated market

Company	Market Share	Product Range
Jain Irrigation	32 - 35%	Drip + Sprinkler
Netafim	14-15%	Only Drip
Plastro Plasson	8 - 9%	Only Drip
Nagarjuna	4 - 5%	Drip + Sprinkler
Parixit	3 - 4%	Drip + Sprinkler
Premier	4 - 5%	Drip + Sprinkler
Others	25 – 27%	Drip + Sprinkler

have established the gains from micro-irrigation adoption and several government and non-government organizations are engaged in actively promoting this technology.

Micro-irrigation technologies can be broadly categorized into two types based on their technical and socioeconomic attributes: low-cost micro-irrigation technologies and the commercialized, state-of-the-art micro-irrigation systems. Low-cost systems include the Pepsee easy drip technology, bucket and drum kits, micro sprinklers, micro tube drip systems and others that have been designed by organizations such as the International Development Enterprises (IDE), along with innovative farmers. The more sophisticated, capital intensive systems are conventional drip and sprinkler systems.

Low cost irrigation systems obviously have been directed to increase the acceptability of the technologies by the poor farmers – those with smaller land holdings and lower returns. Farmers generally can recover the initial cost of investment within one to three years depending on the type of crops to be grown and subsidies and options for financing from organizations and government schemes. These schemes and subsidies will serve as determining factors in decision making by the farmers. In some cases, low cost technology adoption serves as a stepping stone for capital intensive conventional technologies.

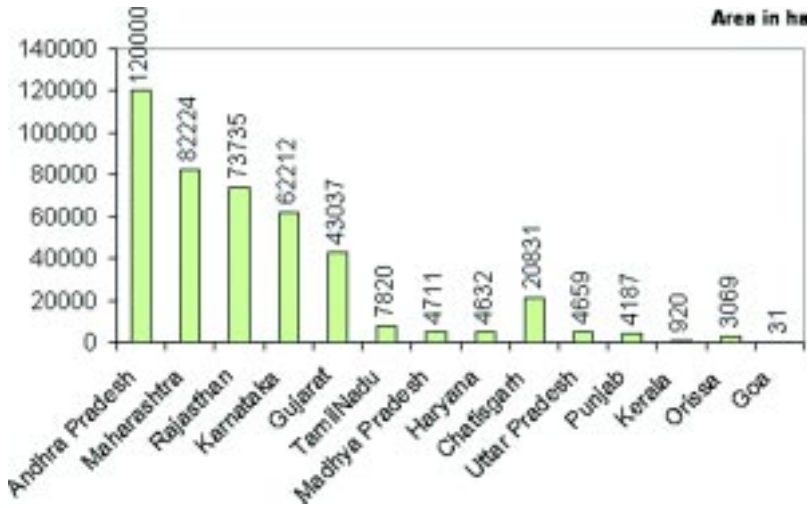
Micro irrigation technologies have been promoted primarily as a means to increase the water use efficiency. In the conventional systems of surface irrigation including flood, canal or others, there are chances of under or over irrigation. The water loss through seepage or percolation or evaporation is a very real possibility and the resultant water use efficiency of the crop is considerably compromised. As water is wisely spent on the crop through this technology, the yield of the crop is enhanced. Drip irrigation saves 25%–60% water and steps up yield by 60%. Sprinklers on the other hand are useful in undulating land with cereals crops and saves around 25%–33% of water.

This technological intervention has brought a perceptible change in the cropping pattern. Among certain adopters of micro irrigation technology, a tendency to shift their cropping patterns to high-value, water intensive crops and also to elevate their production systems to more crop intensive cultures have also been noticed. Not only was there a positive shift in the cropping practices, yields also were reported higher when drip irrigation was used. This increment in yields allow for multiple crops to be grown; for crops to be grown under circumstances where it was not possible when there is an early withdrawal of the monsoon; and for cropping to be intensified in the same field. Farmers who adopt the system also have the possibility of extending irrigated or cultivated area on their land. This has a significant effect on the farmers'

Industry Watch

Current size	**Rs. 650 crores**
Industry growth	**20-30% annually**
Expected size by 2010	**Rs. 1500-1600 crores**
Existing subsidy market	**Rs. 550 crores**

-State wise acreage under micro irrigation 2007-08



incomes, as higher yields bring higher earnings. The improvement in yield is not only in quantitative terms but also in qualitative terms. The drip systems have a potential to improve the quality of harvest. Being said that, shriveled, dried or rotted plant produce are less likely to be produced as these systems are sort of precision agriculture and only the precise quantity of water is applied at regular intervals directly to the root zone and less water is lost due to conveyance.

Another glaring advantage of micro irrigation is that they help to extend water use in times of water scarcity or drought. They allow farmers to plant earlier so that the crop is already established at the onset of rains and can make efficient use of rainwater. This helps to avert a crop loss, or a decline in yield that could arise from a dry spell or the early withdrawal of rain. An early harvest can help farmers avoid many pests and diseases and most importantly helps to reduce labour costs. Also, the lower energy expended in using micro irrigation will have an effect on the overall cost of production. So these systems can help in improving livelihood security of farmers and in increasing incomes.

Although the realized benefits of micro irrigation are aplenty, the extent of adoption in India still presents a bleak picture

Micro irrigation industry of India is still at a very rudimentary stage. Right now, the industry is in the fast track, where it is expected to grow 20-30% annually. Though the information on the actual size of the industry is unavailable, it is estimated from various sources that industry's current size is around Rs.650 crores. Initiatives from various state governments and central government will play a major role in boosting the industry further and it is expected to grow up to the size of Rs.1500 – Rs.1600 crores by 2010.

In India, micro-irrigation technologies have been marketed for more than three decades. The main vehicle of government policies to promote micro-irrigation systems are product subsidies—in certain cases up to 90 percent and the Indian micro irrigation market comprises of both subsidy and non – subsidy players. The existing subsidy market is around Rs.550 crores. The players who fulfill certain essential criteria specified in the guidelines laid out by various State governments and the central government sponsored schemes are entitled to subsidies. They specifically operate in states where State governments have allocated huge budgets for special projects to cover more and more area under Micro irrigation. This market is estimated to grow at a faster pace with the increasing number of projects by Governments of various States, like AP, Karnataka, Tamil Nadu, Maharashtra, Gujarat and Rajasthan with estimated allocations of Rs.2500 crores during the tenth plan. Several other State Governments have also made allocations under the NHM provisions. However, there has been a lukewarm response to such initiatives from farmers, especially

smallholders. This can be attributed to lack of access to groundwater, lack of credit, crop specificity of the available micro-irrigation technologies, lack of awareness, poor product quality and absence of adequate credit facilities.

Also, there exists a non-subsidy market of around 100 crores operating in Tamil Nadu, Haryana, Rajasthan and Maharashtra, where they occupy more than 35% of the market. The non subsidy players have an edge over subsidy players in these regions. Many of the farmers avail their services so as to avoid the hassles of availing subsidy and also to install them at lower price from non – BIS players. More over, they get faster installations from them.

The micro irrigation market is also replete with organized and

unorganized players. There are more than 50 players in organized market; these are the players who have registered their products under GOI. In unorganized market, there are more than 100 players with small base and manufacturing, ranging from few components to full systems. This market includes players who are using local technology and are more concerned about small regional demand.

As micro irrigation techniques stands a good chance to salvage many water deficient fields, there should be concerted effort to popularize these techniques in India

Micro irrigation techniques are primarily targeted towards small cultivators who desperately need institutional and financial support to make such decisions. Their resources in terms of technical know how and credit is limited. Hence the most important aspects that influence the adoption of micro-irrigation are the efforts of policymakers and organizations in long-term service provision and training. Policies must have a strong emphasis on poverty alleviation by income generation for poor farmers, while building awareness and demonstrating the potential of micro-irrigation technologies.

Policymakers must understand that promoting micro-irrigation technologies through capital investments that offer returns over 8-10 years is not the way forward while dealing with resource hit farmers. Even when they are convinced about the returns, farmers might not be in a position to incur huge capital costs. They are more likely to experiment with low cost options that cut initial capital costs by having lower recurrent input costs promising returns within a year. Once the returns start flowing in, farmers may decide to shift to better systems.

Micro irrigation technologies are seen as novel and high risk adventures which need to be introduced to the farmers in a proper way. Mostly, when such kinds of initiatives are launched, they wait for the others in their neighbourhood to adopt them first before trying out for themselves. So some programs should be tried to overcome this obstacle by providing special incentives to the first movers. Also, demonstration plots with institutional support can display the method and results to the fellow farmers.

The market for micro irrigation products is experiencing its second major shift today. There is a considerable demand for locally assembled drip kits or low cost packages than the sophisticated custom built drip irrigation solutions for the commercial farmers. So there is a need to transfer the technology into the hands of the users. Not only should the farmers be educated on the methodology but they should also be made aware of the actual working principle and the working parts so that in case of repair, they are not hoodwinked.

Water scarcity need not be brushed aside as an impending problem. The threat is real and has already arrived. Although for rainfed areas, switching directly from an unirrigated mode to a micro irrigated mode is a big leap, the situation warrants this shift. As it has become evident that our food reserves in the current rate of growth aren't going to do any help to the future population, we need to mend our ways and be frugal in spending water, which in days to come will be a determining factor in raising productivity.

Editorial Team, Agriculture Today

Agriculture Credit: Opening New Vistas

Credit crunch is probably the most uttered word these days. The credit crisis is a global phenomenon and invariably all the sectors are facing the pinch of this deepening crisis. Agriculture, a sector which employs the most work population in this country, has been in this situation for quite some time. Still we haven't got the right answers to our woes. The workers at the grass root level bear the brunt of this credit crunch. Rising prices of the commodities, fuel, transportation, long due debts are some of the woes of the farmers that need a speedy dispatch of cash. Though our focus these days have been on increasing the farm productivity, the effort needs monetary support as well.

Kisan Credit card (KCC) scheme at a glance

- Type of revolving cash credit facility with unlimited withdrawals and repayments.
- Meet the production credit need, cultivation expenses, and contingency expenses of the farmers.
- Limits based on the basis of operational land holding, cropping pattern and scale of finance. This limit is inclusive of 20% of production credit.
- Each withdrawal to be paid within 12 months.
- Card valid for 3 years subject to annual renewals.
- Credit limits can be enhanced depending on performance and needs.
- Rescheduling is also possible depending upon the situation. If for example the crops fail due to a natural calamity and the farmer is not able to repay his loan, then he could get an extension of up to four years.
- Cash withdrawals through slips accompanied by card and passbook.
- A credit cum passbook would be issued.
- All branches engaged in agricultural lending could issue Kisan Credit Cards.

The money lenders ruled the roost in the pre colonial era. But their monopoly is being gradually disintegrated by the various institutional reforms developed over the years by the ruling authorities

The rural credit flow was the play ground of the rural money lenders until 1904 when the colonial government enacted the Co-operative Societies Act in 1904 with the intention of making the co-operatives the premier institutions for credit disbursement. Later this approach gave way to the three-tier structure in 1915. Government was also providing agricultural loans usually called Takkavi loans, which have since been discontinued.

The Independent India gave a major thrust on growth with equity and an institutional credit was perceived fairly necessary to meet the seasonal credit requirement of agriculture. The ineffectiveness of the co-operatives was highlighted by the All India Rural Credit Survey (1951) of the RBI and the rural credit survey of 1966, but their clout in agriculture credit was highlighted. The Imperial Bank was nationalized as SBI, which was then showcased as a vehicle for rural banking. In an effort to organize the rural credit system, many State governments legislated for the registration and regulation of money lenders but with little success in implementing it. Nationalization of banks in 1969 gave a boost to expansion of banks and banking in rural areas.

The Reserve Bank in 1975 instituted Agriculture Refinance and Development Corporation (ARDC) and transferred its role in agricultural credit to this newly formed organization. Soon thereafter, legislation was enacted to create Regional Rural Banks, with participation from Central and State governments and the nationalized banks, with their network spread

almost all over the country. Subsequently, the ARDC was converted into NABARD, which continued to get the lines of credit from the World Bank. The World Bank's lines of credit were, however, discontinued on the ground that functioning of co-operatives had been less than acceptable. Simultaneously, the directed credit in the form of priority sector lending continued and the administered interest rate regime lasted.

During the reform period, capital was infused into the RRBs and the NABARD. While the priority sector lending continued, the administered interest rate regime was dismantled. To make up for the shortfall in the priority sector lending by the banks, the Rural Infrastructure Development Fund (RIDF) was initiated to ensure the envisaged flow of bank resources to agriculture through the intermediation of the NABARD and the State governments. A system of Special Agricultural Credit Plan was also introduced. Innovations in the area of rural credit included Kisan Credit Cards and encouraging bank-SHG linkages. It may also be of interest to note that many District and State Co-operative Banks are yet to meet the applicable minimum capital requirements.

More recently, since 2004, vigorous efforts have been made to more than double the credit flow to agriculture. Emphasis has been laid on sound credit culture, effective credit delivery and appropriate credit pricing. New instruments for financial inclusion such as General Credit Cards and no-frills accounts were initiated. Micro finance programme was intensified and new guidelines for business facilitator model were issued. Use of technology for rural banking is being encouraged. Special Area Plans for banking in several states such as Uttaranchal, North Eastern States, Chattisgarh, Bihar and Andaman-Nicobar have been formulated to suit the local conditions. In terms of institutional development, consolidation of the RRBs, revamping of the urban co-operative banks as per the vision document, revival of rural co-operative credit structure as per the Vaidyanathan Committee recommendations, a plan for restructuring of long-term lending institutions for agriculture, and a revisit to the prescriptions relating to the priority sector lending are underway. Above all, as per the Government of India announcement in 2005, it has been decided to subsidize the commercial banks and NABARD to enable provision of short-term credit at 7% interest rate to the major segment of the farmers. In brief, there have been vigorous and determined efforts towards expansion of rural credit, especially through rural banking.

Table 4: Loans given to farm sector in different years

Years	Co-Op banks	Regional rural banks	Commercial banks	Total
1997-98	14085	2040	15831	31956
1998-99	15957	2460	18443	36860
1999-00	18429	3329	22854	44612
2000-01	21909	3807	27788	53504
2001-02	27080	4956	34735	66771
2002-03	23716.4	6069.79	39773.6	6959
2003-04	26958.79	7581.15	52440.85	86981
2004-05	31424.23	12404	81481.41	125309
2005-06	39403.77	15222.9	125858.9	180486
2006-07	42480	20435	140382	203297
2007-08	33070.17	15924.56	88764.83	137760

Source: Reserve Bank of India

Banking sector nation wide has now changed their perspective in helping out the rural populace. More and more schemes are now developed and channelled through the banking sector

Bygone was the era when banks were concerned with money matters alone. Now, the banking sector has parted their old ways and is now treading newer paths. Banks have now donned on some new roles - Marketing, training and consultancy, insurance and financing for infrastructure via Private-public participation. Predominantly, the Indian banking sector consists of commercial and cooperative banks. Cooperative banks were primarily recognized for their role in financing the rural economy. But with changing economic situations, commercial banks too have come forward to extend credit to agriculture.

The public sector banks had extended Rs.1549 billion, constituting 15.22 per cent of the net bank credit, to the agriculture sector towards the end of March 2006. Private sector banks had also followed the same line and have extended Rs.361.8 billion to agriculture by the end of March 2006, thus constituting 13.5 per cent of net bank credit. Up to November 2007, the flow of credit to agriculture from the scheduled banking sector was Rs.1493.4 billion, about 61% of the annual target. Enthused by this spectacle, the Budget 2007-08 did set a higher target of Rs.2250 billion for disbursement of credit and a further addition of 5 million new farmers as borrowers to the banking system, to improve credit flow to the agriculture sector. In Budget 2006-07, banks (including cooperative banks and RRBs) were urged to disburse Rs.628.1 billion as credit to agriculture sector during 2006-07. The overall achievement during 2006-07 was Rs.2033 billion. Also, new farmers covered under the institutional credit system were 8.35 million against the target of 5 million. The recent years have seen substantial increases in the flow of credit from commercial banks to agriculture and allied activities. But they are still far behind their target of 18% as set by RBI. Also, the number of bank branches at rural centers has decreased from 35,329 in 1994 to 32,481 in 2002.

Kisan Credit card (KCC) scheme is

another gesture that has been made in order to ease the flow of credit to the farming community, the credit needs of whom are distinctly seasonal and varied. This scheme was introduced by Government of India in consultation with the RBI and NABARD during 1998-99. Of the total 66.6 million cards issued as on 31 March 2007, co-operative banks accounted for 49 per cent of the share, followed by commercial banks (38%) and RRBs (13%).

A revolutionary step in making the credit access is the microfinance programme. NABARD has been making continuous efforts through its micro-finance programme for improving the access of the rural poor to formal institutional credit. The Self Help Group (SHG) -Bank Linkage Programme was introduced in 1992 as a mechanism to provide the poor in rural areas, at their doorstep, easy and self-managed access to formal financial services on a sustainable basis by enabling them to gain access to banking services in a cost-effective manner. Around 547 banks (47 commercial banks, 158 RRBs and 342 co-operative banks) are now actively involved in the operation of this programme. As on December 2007, 30.51 lakh self-help groups (SHGs) availed bank loans of Rs.20,114 crores. The average bank loan availed per SHG and per family amounted to Rs.65,924 and Rs.4,078, respectively. During 2006-07, as against the target of 3.85 lakh new SHGs, as on December 31, 2006, as many as 2.38 lakh SHGs were credit linked and bank loans of Rs.13,511.86 crore were disbursed. There are about 498 banks (50 commercial banks, 96 amalgamated RRBs and 352 cooperative banks) actively participating in microfinance programmes.

Various Insurance schemes have been introduced over the years to cope with agri-risk factors

Agriculture is a field that has been dominated by factors beyond the control of humankind. Natural disasters of the order of flood, drought, forest fire, earth quake,

landslides have been reasons enough for farmers to loose their crop and their livelihood. Several biotic factors such as pest and diseases also possess the potential to deprive the farmers of any possible income. This unsteady and wavering field so requires a back up, something which vouches for this unsteadiness. So with best intentions, several insurance schemes have been introduced by the government.

To enlarge the coverage in terms of farmers (loanee and non-loanee both), more crops and more risks, Government introduced a scheme (in place of Comprehensive Crop Insurance Scheme-CCIS) titled, 'National Agricultural Insurance Scheme (NAIS) – (Rashtriya Krishi Bima Yojna)' from Rabi 1999-2000 season in the country. This is currently being implemented by 23 States and 2 Union Territories. At present, 10% subsidy in premium is available to small and marginal farmers, which is to be shared equally by the Centre and State Governments. The National Agricultural Insurance Scheme (NAIS) scheme, since its inception and until rabi 2006-07, about 97.1 million farmers have been covered. This scheme covers all food grains, oilseeds and annual horticultural / commercial crops for which past yield data are available for an adequate number of years. The coverage area is 156 million ha and the sum insured is Rs.926 billion. Claims to the tune of about Rs.98.5 billion have become payable against the premium income of about Rs.29.4 billion benefiting nearly 27 million farmers.

Sixty five percent of Indian agriculture is heavily dependent on natural factors, particularly rainfall. Studies have established that rainfall variations account for more than 50% of variability in crop yields. To mitigate the variations in rainfall affecting the yield parameters, a scheme- Varsha Bima was introduced in 2005. Varsha Bima covers anticipated shortfall in crop yield on account of deficit rainfall. Varsha Bima is voluntary for all classes of cultivators who stand to lose financially upon adverse incidence of rainfall and can take insurance under the scheme. Initially Varsha Bima was meant for cultivators for whom National Agricultural Insurance Scheme (NAIS) is voluntary. Sookha Suraksha Kavach is also another exclusive rainfall insurance product for drought stricken farmers of Rajasthan. Similarly there is also Rainfall Insurance Scheme for Coffee Growers which was introduced by Agriculture Insurance Company of India Ltd to provide insurance cover for possible losses in coffee yield arising out of rainfall risks. The risk covered is deficiency in rains during Blossom and Backing periods as well as excess rains during Monsoon Period (July and August in Karnataka).

Another broad based scheme is Weather Based Crop Insurance which aims to mitigate the hardship of the insured farmers against the likelihood of financial loss on account of anticipated crop loss resulting from incidence of adverse conditions of weather parameters like rainfall, temperature, frost, humidity etc. It provides payout against adverse rainfall incidence (both deficit & excess) during Kharif and adverse incidence in weather parameters like frost, heat, relative humidity, un-seasonal rainfall etc. during Rabi. It is not Yield guarantee insurance. Another weather insurance scheme is the Rabi Weather Insurance, which is a mechanism for providing effective risk management aid to those individuals and institutions likely to be impacted by adverse weather

incidences. Wheat, Mustard, Gram, Potato, Masoor, Barley and Coriander are the major Rabi season crops mostly in the states of UP, MP, Maharashtra and Rajasthan. These crops are extremely vulnerable to weather factors, such as excess rainfall, frost, and fluctuation in temperature etc.

Several specific crop based insurance schemes are also available. One such scheme is Wheat Insurance Policy which is Unique Index insurance product based on biomass (Normalized Difference Vegetative Index) and weather parameters like temperature & rainfall. Mango Weather Insurance provides protection against adverse deviations in a range of weather parameters like frost, temperature range, rainfall, wind speed etc. during mango flowering to harvest in select locations of Andhra Pradesh, Maharashtra & Uttar Pradesh. Poppy Insurance scheme is applicable to Poppy crop cultivated by the farmers in the areas notified by the Government of India, under license issued by the Central Bureau of Narcotics (CBN). Loss or damage to the insured Poppy crop occasioned by natural calamities like Flood, Cyclone, Storm, Frost and Pest & diseases etc., leading to uprooting of crop before commencement of lancing operation, under the supervision of CBN.

Another interesting insurance scheme brought forward by the Agriculture Insurance Company of India Limited (AIC) is the Seb Bima Yojana. Adverse weather conditions like inadequate Chilling Units Accumulation, Temperature Fluctuation, Inadequate Rainfall and Hail storms during flowering & fruit development many a times hamper the productivity of apples leading to financial insecurity among the apple growers of Uttrakhand. This risk mitigation tool in apple is designed in collaboration with Uttarakhand State government for the Apple growers and producers in Uttarakhand, whose produce/ yields are likely to be affected by the adverse weather conditions.

There are also several other insurance schemes targeted for specific crops such as potato insurance, Bio-Fuel Tree/Plant Insurance, Pulp wood Tree Insurance, coconut insurance and rubber insurance.

Though many strides have been achieved in mobilizing credit to the rural areas, there are several areas which needs to be improved trimmed

While defining a credit policy, there cannot be a uniform system of rural financial system across the country. On the contrary, it should be flexible and decentralized, suited to the local socioeconomic milieu. Small borrowers are the discriminated lot and hence policy emphasis on them should continue. Any attempt by the political parties to waive the debts should be opposed as it will encourage non repayment of loans. The role of non formal organization should be emphasized as the poor need their help in availing institutional credit and they can serve as a friendly intermediary.

Group approach to lending has been found to be cost-effective where the rate of recovery is also high and the lender's risk low. So promotion of groups of homogeneous borrowers (produce based, service based, caste based, village based, cluster based, vertically integrated or horizontally integrated) is a viable option which needs to be further exploited. Involving NGOs or rural educated youths for organizing farmers or rural families in groups, scrutinizing applications, and disbursing loan and effecting recoveries may help financial institutions in reducing their lending costs. As the risks for lenders and borrowers are considerably higher in agriculture, apart from group lending, insurance can be considered as an important instrument, the popularity of which needs to be increased with proper awareness campaign.

The commercial banks while dealing with agriculture credit should recruit agricultural graduates for rural branches and should take the help of local NGOs, self-help groups or village development functionaries in the appraisal of loan applications to save time and cost. RRBs should be given greater autonomy and flexibility in planning and lending policies, to restore their comparative advantage in rural lending. The cooperative credit system should be rejuvenated by recapitalization and giving the cooperatives greater autonomy and infusing greater professionalism.

Agriculture is an important source of income for majority of the population and will continue to remain so for many years to come. Globalization and economic liberalization has opened up many new vistas for this vocation. But at the same time this has also exposed a deeper problem which has been left under attended and many times unattended – Credit crunch. Even though recent years have seen a perceptible increase in the flow of rural credit from institutional sources, the share of the informal sector, notably traditional moneylenders and traders, in farmers' outstanding debts remain as high as 43.3 per cent at the all-India level. This is a disturbing figure considering the exorbitant rates of interest which is estimated to be of the order of 18% and 36%. An effective mechanism is still needed to revamp and rejuvenate this sector, which will eventually help to unlock the true potential of this industry.

Editorial Team, Agriculture Today

Public-Private Partnership: A Boon for Agriculture

Vishal Khullar*

Independence, Green Revolution and Globalization (WTO) are the three events in agricultural history of India, which have changed the global image of the country from 'food-dependent' to 'food self-sufficient' nation. The three events are in sequence and are inter-related. After the Independence had been achieved, there was a challenge to feed the starving countrymen. To meet this challenge, the idea of Green Revolution evolved. It fed the country. Its momentum drove the rural economy for decades. But overall, economy of India was in very bad shape when the World Trade Organization (WTO) Agreement was signed to get rid of the financial burden of World Bank (International Rural Development Bank) and International Monetary Fund (IMF). Finally on January 01, 1995, WTO was implemented in the country.

The dawn of Globalization era brought not only relief from the debt of International Agencies, but also brought new challenges to meet the global standards. It was *déjà vu* of what happened in 1947. Now, the changes were there. There were no stringent trade restrictions across borders. The concept of market was globalized. All the Infrastructure, Activities, Human Resource, Procedures, etc., were to be moulded or directed towards the new path. This paved the path for openness in the procedures. Finally, it ended the procedural bottlenecks like licensing which was a hindrance for private players.

Now the private companies, Multinational Corporates in particular, are playing important role and possesses significant share in the agriculture sector. Corporates participate in almost all activities related to agricultural inputs. Machinery, tools, implements, seeds and fertilizers are the areas where the involvement of the private sector was known traditionally, even before Globalization.

Traditionally, the public sector including State Agricultural Universities (SAUs), Indian Council of Agricultural Research (ICAR) and Deemed Agricultural Universities had monopoly in the area of agricultural research & development and extension activities. After the Liberalization era, multi-national companies were found to be oriented towards Research & Development and Extension Activities. There was a role-shift. With the changing scenario and needs, the Private sector excelled and got ahead of the Public Sector within less than a decade's time. Due to better planning, appraisal, implementation, monitoring, infrastructure, financing, marketing, evaluation and simpler procedures, huge-profits were made that further led the sector towards betterment, leaving public agencies far behind even in Research and Development & Extension Activities.

But one thing that the Private sector could not achieve like public sector, even with a decade, is hard-earned rapport of public agencies with the farmers. From 1960s onward, public agencies are dealing with farmers and farmers have immense belief in these agencies. A decade's experience has taught them the lesson that some notorious private players may cheat them and this experience has hurt not only them, but also the genuine private companies. For adoption of any new technology, farmers do consult the public agencies. This situation has necessitated the role of Public sector. On the other hand, Global scenario has proven the working of public sector as 'inefficient' for implementation of projects and has designated the role of Private sector as necessary for implementation purposes.

In the present situation of need, there is a way for which, will is desired. The way is Public Private Partnership (PPP) and is commonly used by policy makers and scholars as a solution to fight against the woes of farming community. A number of examples can be cited where PPP has produced wonderful results in the agriculture sector. After all, PPP has its roots in economic history of the nation.

The very crux of existence of Public sector lies in supporting the Private sector so that the Public sector can initiate and carry out investments in those areas where profit-making is rather impossible task, the incentive for which the Private sector works. Hence, Public sector may not have efficient-role of profit making but its social justification cannot be ignored. Both the sectors have their own merits and limitations. Both are necessary for growth and development of agricultural sector in the Globalized scenario of today's world. Both sectors have their Brand names- Public for Authenticity and Private for Efficiency. Therefore, the Public agencies should take up the role of authentic monitoring of the projects, while Private should be allowed the implementation job.

Let's remember Public Private Partnership as the mantra for another Green Revolution!

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Saving Crop Saving India

Even after years, agriculture still claims to be the backbone of the rural community in India. Agriculture is the income provider for more than sixty five percent of the population. Although the contribution of the agriculture to Indian GDP has gone down considerably in the last few years, this sector continues to be the largest economic sector in India. The diminishing clout of this proletarian sector in India's bourses has raised concerns considering the dependency of two thirds of the Indian population on it for survival. So discussions on sustainability, biodiversity, hybrid varieties, transgenic crops, enhancing productivity are doing rounds in the scientific circles and among policy veterans. Amidst these talks of injecting prosperity into the Indian farming scenario, the relevance of plant protection in saving losses amounting to crores of rupees has been vastly undermined.

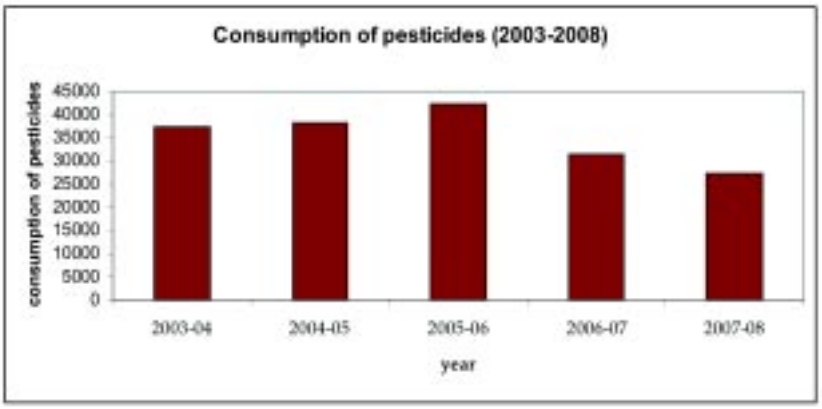
The crop losses due to pests, diseases and weeds are approximately assessed to be in the range of 10-30% of crop production. When translated in to numbers, this will amount to Rs.90,000 crores per annum, according to a report of Parliament's Standing Committee on Chemicals - the result of depriving around 80 per cent of the cultivated area of proper crop-protection measures! "The appropriate use of pesticides is an insurance against losses by insect pests and diseases. As reported by the Union Minister of Agriculture while responding to a starred question No. 62 in Rajya Sabha on 2 March 2007, the crop losses due to pests, weeds and diseases are approximately assessed to be ranging between 10 to 30% of crop production. If we consider, on an average, crop loss of 20% , and the present gross value of our agriculture produce as Rs. 7 lakh crore, the loss comes to Rs.1,40,000 crore, which is very huge. Even if we could save 50% by using plant protection chemicals, it will add Rs.70, 000 crore additional income to our farmers. At a time, when all of us are concerned about National Food Security, can the country afford these losses?

It was therefore, expected that the Government would make specific budgetary provisions in this Interim Budget for educating the farmers about assured and judicious use of pesticides, to the extension personnel that pesticides use is an important component of the Integrated Pest Management. Further, instead of step-motherly treatment to agro-chemical industry by levying 14% Excise Duty on Agro-Chemicals Industry, it should be equated with the Fertilizers Industry for subsidy, excise duty, VAT etc. Such provisions would have provided a policy framework for those who would be presenting the Budget 2009-10 after the new Government is formed," argues Mr. R.G. Agarwal, Chairman, Crop Care Federation of India.

Not only does the sector incur monumental monetary losses due to these factors, as an industry it is letting away the spectacular export opportunities under the liberalized WTO regime. The export market demands the products to be on par with international quality standards. The discerning Indian consumers also expect the commodities to be of good quality. Moreover, in this era when there is mounting pressure on each unit of cultivated land to produce more, it is only logical to assume that saving these losses is as good a strategy as increasing production. Appropriate crop protection strategies are a good way to begin with.

The current thrust area in plant protection is strengthened around some great ideals

The Indian government has realized that plant protection demands considerable attention. The major thrust areas of plant protection in India are promotion of Integrated Pest Management (IPM), ensuring availability of safe and quality pesticides, streamlining the quarantine measures and for human resource development including empowerment of women in plant



Source: www.indiaagristat.com

protection skills. The schemes are being implemented by Plant Protection Division of the Department of Agriculture and Cooperation through Directorate of Plant Protection, Quarantine and Storage.

Considering the ill effects posed by chemical pesticides, Government of India has adopted Integrated Pest Management (IPM) as the cardinal principle and main plank of plant protection strategy in the country. IPM is an eco-sensitive approach which relies on an array of pest management strategies. Unlike emphasizing on a single pest control method, it is a multi pronged strategy utilizing the available alternative methods for pest control like cultural, mechanical, biological and use of bio-pesticides. The whole strategy revolves around the concept of maintaining the pest under economic threshold levels - the level of pest attack where the estimated benefits of treatment cover the cost of that treatment. If the level of attack is below the threshold, the cost of treatment would exceed the benefits and the farmer would make a loss by applying the treatment.

In India, IPM related activities are being implemented through 26 Central Integrated Pest Management Centers (CIPMCs) located in 23 States and Union Territories. The major activities under IPM approach include undertaking sample roving surveys for monitoring pest/disease situation on major crops, production and release of Bio-control agents and conducting Farmers' Field Schools (FFSs). As this is a strategy that involves constant monitoring at the field level, the programme needs a marked presence at the grass root level which is accomplished by the field stations. The pest situation reports received from field stations and States are compiled and, comprehensive weekly and monthly reports are circulated to the concerned officers and scientists of State Departments of Agriculture/State Agricultural Universities and ICAR Institutes so as to help them take appropriate remedial measures.

Bio- control agents, though are not the only method under IPM, they are considered a very important part of IPM. To enhance the production of bio-control agents/bio-pesticides, Government of India earmarked Rs 1500 lakh as grants-in-aid during the Eighth and Ninth Plans for establishment of 29 State Bio-control Laboratories of which an amount of Rs 1372 lakh has been released to States. During the Tenth Plan, an amount of Rs 470 lakh has also been approved of which Rs 405 lakh has already been released so far for the said purpose. With the adoption of IPM approach, consumption of pesticides has come down from 72,133 MT (tech. grade) during 1991-92 to 40,672 MT (tech. grade) during 2004-05 and there is consistent increase in the use of bio-pesticides which are environmentally safe.

For any policy or plan to get materialized, an active participation of the stake holders is necessary. Even before that there must be enough awareness built among the farmers. For this mission, Farmers' Field Schools (FFSs) have been launched including State extension functionaries and farmers. These schools conduct demo-cum-training programme. These FFSs training programmes also involve women farmers and NGOs to ensure greater public participation in the IPM Programme. Further, various training programmes are also conducted across the country to train Central and State Government officials.

Biopesticides is still a mirage

Rachel Carson's book, 'Silent Spring' in a way exposed the darker side of the chemical pesticides and paved the way for a new environmental thought that promoted eco friendly products. In the quest to find more reliable products, even live organisms have been experimented with to achieve the intended results. The indiscriminate use of chemical formulations- such as insecticides and fungicides has left an indelible scar on the environment. Many cases of suspected ill effects of insecticides have been surfacing from various parts of India. Though on paper, IPM is the main plank of plant protection policy in India, it is seldom taken in that sense by farmers. They resort to indiscriminate use of pesticides resulting in many unwanted effects- the foremost being the presence of pesticide residue in the farm produce. Also, they have a share in polluting the water bodies with chemicals which in fact find a way back in to the human system. They have also corrupted the soil with loads of chemicals. Their excessive interaction with the environment has bereaved it of many useful organisms which could have otherwise been helpful in bringing down the pest/ pathogen population to a controllable level. In many instances, this has led to the resurgence of secondary pests. A classic case is the Brown Plant Hopper infestation in rice. A key strategy in IPM is to avoid pest resurgence. Another unintended effect is the development of resistance in the pest/pathogen population to the applied pesticides. Biological control has emerged as an alternative choice to battle the side effects of the chemical intensive approach. This method basically

comprise of live sources for the management of plant problems. These living entities are diverse ranging from microorganisms to plants. Microorganisms such as *Bacillus thuringiensis* have already established their efficacy in controlling many pests. Similarly, other established micro biocontrol agents include Nuclear polyhedrosis viruses, granulosis viruses, fungi such as *Beauveria bassiana*, *Metarhizium anisoplae, Trichoderma,* etc. and bacterial agents such as *Bacillus sp., Pseudomonas fluorescens, Agrobacterium radiobacter* etc. Apart from live organisms, some plants and the extracts made out of them are also used in controlling many pests. The most prominent ones are neem, turmeric, garlic etc., which in one form or the other helps in bringing down the population of the pest.

The effect of bio control agents though proven has not been able to make in roads in to the actual agricultural field on a wide scale. But another innovation has taken hold of the Indian territory by a storm- the Bt cotton. Built on the principle of biopesticide, this variety of cotton has been massively adopted by the Indian cotton farmers. In India, Bt cotton is widely used and the acreage stood at 6.20 mn ha for 2007, a growth of 63% over the previous year. The market for Bt products is expanding incredibly. This has not been replicated in the case of traditional biopesticides.

Biopesticides have found immense utility in organic farming catering to niche market as there is no other way of managing pest problems. "Most critical aspect in organic farming is the protection of crops from insects, pests and other diseases due to viruses, bacteria, fungi, etc. To accomplish this, a multi prong approach including the use of bio pesticides, bio fertilizers, herbal and plant based preparations, pheromones, light traps, animal dung and urine based products along with the use of resistant crops through planned breeding by utilizing biotechnological tools should be tried and standardized for different crops in various geographical areas of the country," says Prof. M. P. Yadav, Ex- Vice Chancellor, SBVPUAT, Meerut.

Though bio pesticides have been touted as a viable alternative to the chemical means, many doubt the efficacy of bio entities in managing pest problems. The success of bio control agents has been mainly limited to the labs and in many cases they have failed to replicate the result in fields. At present, only 8 biopesticides are registered in India. Their development is still at nascent stage, and their action is mostly preventive in nature. They have comparatively poor shelf life. Some spurious products make their way in to the market in the guise of bio pesticides and according to recent report from APEDA, traces of pesticides namely, Profenophos, and Abamectin have been detected in grapes formerly believed to have sprayed with biopesticides. Many believe in this era of shrinking productivity and cultivable land area, this approach can hardly take us anywhere. "We need to bear in mind that a country like India which is still struggling for enhancing at a fast rate its agricultural production, bio-pesticides do not offer a plausible alternative / substitute to synthetic chemical pesticides. At the most, I see a scope for bio-pesticides as supplement crop protectants, and that too for very limited crops and area," asserts M. K. Dhanuka, Managing Director, Dhanuka Agritech Limited, New Delhi.

Chemical pesticides/fungicides are still Indian farmers favourite

Even though a lot are being said and done against the frivolous use of pesticides, they are the fastest choice that farmers make in a given situation. The reasons being – immediate action, obvious results, easy use and most of all it comes in a cheaper package. Their dominance in Indian agriculture has never been challenged. Even the large scale adoption of Bt cotton which is supposed to bring down the money spent on pesticides, has not shattered the hopes of pesticide industry. "I don't foresee any threat from biotechnology and GM crops. It is only a recent phenomena that introduction of GM crops like Bt. transgenic in cotton, and may be of other crops become a reality. The total area planted in the country under Bt. cotton has gone up from 6.2% in 2004-05 to 39% in 2006-07 (Economic Times, 2007). This may lead to initial reduction in pesticides use on transgenic crops. Bt. cotton has appropriate genes introduced for control of *Helicoverpa* and *Spodoptera*, and farmers are using pesticides to control other insect pests. Under such a scenario, in a few years, the GM crops may develop resistance problem to one or two target insect pests, while the resurgence of other minor insect pests may also occur, for which pesticides like imidacloprid ,

acetamiprid or thiametoxan will be required . The farmers have controlled successfully Lepidoptera insects but are now facing increased infestation of sucking insect pests' namely Mealy bug, Whitefly, Jassids, Thrips, etc. The GM crops need to be fit-in an Integrated Pest Management (IPM) system", believes M. K. Dhanuka, Managing Director, Dhanuka Agritech Limited, New Delhi.

Meanwhile, the clout of pesticides in raising India's production is an undisputed fact. "There is wide scope to enhance crop productivity through effective suppression of pests, diseases and weeds. The classical example is of cotton. The cotton production has increased from 100 kg lint per ha to now 560 kg lint per ha between 1950 to 2007. A critical analysis of the decadal growth revealed that varietal improvement and plant protection helped increase productivity to 300 kg lint per ha till 1990. However, when insecticide resistance built up, the productivity remained stagnant till 2002. The Bt cotton meant for inbuilt bollworm resistance did the magic of saving the crop from bollworms and increased the productivity by another 250 kg lint per ha. A reverse analysis clearly indicates that the cotton hybrids have a potential to give average productivity of 600 kg lint per ha but in the absence of any plant protection can yield only 250 kg lint. Thus indicating a loss of 60% due to pests. Take another example of grapes, in the absence of pest control one can loose grape production by 90% due to downy mildew, powdery mildew, anthracnose, mealy bugs, Botrytis rot etc. Therefore, significance of agrochemicals in increasing agricultural productivity cannot be denied," says Dr. C. D. Mayee, Chairman, ASRB.

Consumption of pesticide on a per hectare basis in India is lower when compared to other nations. It is less than 280g per ha as against a whopping 17.0 kg/ha in Taiwan, 11.0 kg/ha in Japan or 2.5 kg/ha in Europe. But it may not be presumed that since we are the lowest consumer of chemicals in the world, we are shy in using chemicals. The Indian farmers have been partial towards certain crops by indulging them with more pesticides. For instance, cotton consumed 43.5% of the total pesticides use where as rice 21.8% and pulses 8.1 % . The percentage use in chilies and plantation crop was 5.7 and 5.0% respectively. All these six crops consumed 81% of the total pesticides use.

The Indian pesticide industry with 85,000 MT of production during FY 07 is ranked second in Asia (behind China) and twelfth globally. In value terms, the size of the Indian pesticide industry was estimated at Rs.74 bn for 2007, including exports of Rs.29 bn. In India, the industry is very fragmented with about 30-40 large manufacturers and about 400 formulators.

Even among the pesticides, insecticides are the fast moving category which accounts for 64% of the total pesticide consumption in FY07. India due to its inherent strength of low-cost manufacturing and qualified low-cost manpower is a net exporter of pesticides to countries such as USA and some European & African countries. Exports formed 39% of total industry turnover in FY07 and have grown at a Compounded Annual Growth Rate (CAGR) of 18% from FY 03 to FY 07.

Prior to 2005, i.e. in the process patent regime, Indian companies focused on applied research and concentrated on marketing generic and off-patent products. Due to this, the R&D expense by Indian companies was lower at approximately 1% of turnover. Global companies focused on high-end specialty products and dominated the market for patented new molecules. However, with the onset of the product patent regime in India, the Indian companies will need to increase R&D expenses to meet competition from MNCs. Alternatively, Indian companies can be competitive in the area of Contract Research and Manufacturing Services (CRAMS).

With the advent of the Integrated Pest Management (IPM) technique, the use of biopesticides and Genetically Modified (GM) seeds has increased. GM technology has been mainly used in commercial crops like cotton, maize, soyabean and canola. Cotton has been the biggest consumer of pesticides in India. With the advent of Bt cotton, the pesticide consumption for that crop initially declined. In India, Bt cotton is widely used and the acreage stood at 6.20 mn ha for 2007, a growth of 63% over the previous year.

Pesticide industry has been under attack from different quarters, although they have played a big role in agriculture production. Many pro environmental groups have launched rhetoric against pesticides as they believe that the pesticides are culpable in polluting the natural resources. The advent of biopesticides and particularly GM crops will shake the monopolistic regime of pesticides. The consumption of chemical pesticides have been found to be reduced although the per hectare consumption has increased from 154grams per hectare in 1960 to 280 gram per hectare in 2007. The industry is also troubled by instances of spurious chemicals which can further tarnish their reputation. There is still no effective mechanism to check the flow of such dubious substances. Also, in an effort to salvage the crop from pest and

diseases, sometimes farmers may indulge in indiscriminate use of chemicals. So the pesticide industry, having understood this fact is now advocating the judicious use of chemicals. Now their marketing strategy has changed and has gone beyond just popularizing their own brands. They have started to lend even technical assistance to help the farmers. For instance, Crystal Phosphates, part of Rs 500-crore Crystal group, and among the country's top five agrochemical companies, is set to adopt around 200 fields in the Punjab agriculture belt. According to NK Agarwal, Chairman, Crystal Group, "Crystal and farmers work on one common mission, that is, to increase productivity. Our efforts will help farmers increase the yield and thus keep them motivated about their main occupation agriculture." Crystal will spend about Rs.1.5 crores on this project and has deputed a team of 89 technicians and specialists on this project. "Our specialized team will visit key agriculture belts in Punjab and advise the farmers on measures to be taken to maximize the yield. Proper use of agrochemicals and inputs suggested by our expert team can fetch a farmer an additional 10% yield from his field," added Agarwal.

IPM strategies have a long way to go from paper to prairies

IPM is a pro environmental approach and advocates the use of pesticides as only a last resort. Though a lot of policies and amounts are earmarked for this way of crop management, very little actually happens at the farmers' level. Majority of the farming community are still comfortable with using pesticides as the only resort. Most of them are uninformed. Also, these strategies take time to show results, so are not competent enough to reproduce the spectacular effects shown by pesticides. Moreover, the Indian farming situation is subjected to vagaries of nature and hence the effects of the likes of biopesticides which vary with temperature will not be consistent through out the nation. IPM strategies have only been worked out for a few crops- rice, sugarcane and cotton pests. Pesticides which are selective against a pest and not against the natural enemies in the ecosystem are virtually unavailable. The whole concept of IPM revolves around economic threshold level of pests which hasn't been worked out for all the pests and combination of pests for different varieties and regions. A few IPM demonstrations held randomly across the country in a chosen few spots is not the way to implement the programme if the authorities are serious about the issue. So, adequate extension activities and facilities must be carried out on a large scale.

Most of the chemical pesticide manufacturers/firms/dealers although carry out activities related to development of the rural society, they seldom try to create awareness among their customers regarding the ill effects of pesticides. They always try to make pesticide as the only component of crop protection and not treat them as part of the programme. IPM training programmes and FFS in farmer's field should be carried out on large scale throughout the country to create awareness among farming community regarding adverse effects of indiscriminate use of pesticides and usefulness of IPM practices.

The government should try to highlight the adverse effects of chemical pesticides and usefulness of IPM through AIR and Doordarshan more frequently to create awareness among the masses in general and farmers in particular. Participation of NGO's, womens' organizations, Panchayti Raj Institutions must be encouraged to have greater physical impact of IPM programme at grass root level. Farmers should be given subsidy on biopesticides, bioagents, biofertilizers and neem based pesticides in order to reduce load of chemical pesticides. Periodical reviews of all IPM programmes being carried out by Centre/State/Private agencies should be made by IPM authority constituted for the purpose.

World as a whole had been through several crises in the recent past – including food crisis. It has become imperative that there is an aggravated necessity of raising the food production. It is an undisputable fact that 10-30% of whatever produced is lost due to the ravages of pest and diseases. Each morsel of food saved in this period is equivalent to food produced. So it becomes all the more necessary to salvage these losses which by the way is preventable. Using pesticides alone as a crop management strategy is not the solution. The impact of pesticides on the biodiversity and the environment should not be overlooked, as the key to our food security is the rich biodiversity. So a holistic approach like IPM which combines the benefits of prophylactic measures and treatment regimen has to be resorted to. The most vociferous argument in favour of using chemical pesticides is that it is the only means to raise the current food production. But resorting to a one point strategy like this is a short sighted plan. We need a long term plan that will not only raise our food production but also assure there is enough scope for it in the future.

Editorial Team, Agriculture Today

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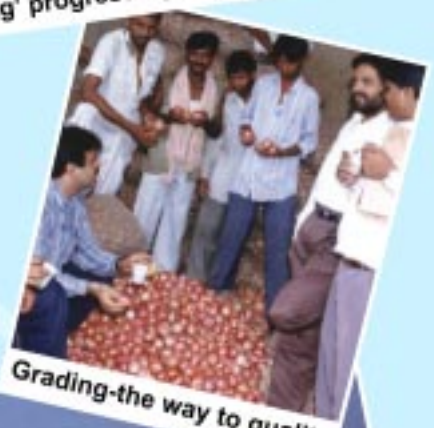

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Livestock

ANIMAL HUSBANDRY

RESEARCH AND POLICY PERSPECTIVE

Dr KM Bujarbaruah

It is a matter of pride that Indian economy is growing between 6 and 8 per cent due to the contribution from industry, service, agriculture and other sectors. However, maintaining sustainability of agricultural growth on the face of challenges it is facing today is a matter of concern. Within agriculture, the livestock sub sector fortunately has positioned itself very well so far as its production is concerned. India today is the home for 16.10, 56.50 and 16.50 per cent respectively of world's cattle, buffalo and goat population. In sheep and poultry, India is 5th in the world, while the position with regard to pig is 17th. In production front, our milk production has been growing at a rate of 3.3 million tones per annum since 2000-2001 with the present production of 101 million tonne, maintaining thereby a steady growth of around 3.72 per cent. With 7.94 % growth in poultry meat and 2.22% in non-poultry sector, an overall growth rate of 5.08 per cent has been recorded in meat sub-sector besides a phenomenal 27 times increase in egg production today since 1950-51 when we produced only 1.8 billion eggs. Per capita availability of milk and egg has also increased from 220 g and 36 numbers in 2000-2001 to 245 g and 46 numbers in 2006-2007. The share of export of livestock products has also increased from 3.3% to 6.9% in the period between 1981 – 1985 and 1999 – 2004 besides increasing the contribution of livestock sector to agriculture from 19.8% to 25% in the same period. This is also the sector, the strength of which has been amply recognized today in so far as providing economic and social security to 52 per cent of India's population engaged in farm sector is concerned. All these developments have been possible due to timely generation and provisioning of needed technologies-be it in health or production aspects, ranging from the development of advanced disease diagnostics/vaccine production capabilities to improved strains and feeding packages.

However, it is again a matter of concern that in spite of the country showing its potential to become an economic power in the emerging global environment, the country is the home of around 200 million people living below poverty line, 80 million protein-energy malnourished children and a sizeable women population suffering from anemia. In order to improve the condition of this section of society, the government has come up with many innovative ideas including the latest announcement ear marking Rs. 25,000 crores for agriculture sector development as it is this sector and within it the livestock sub-sector that can address the issue of poverty reduction, protein-energy balancing and providing nutritional security. All out efforts are required to boost up livestock sub sector where the 70 million population is directly involved to produce quality food for 70 % or 882 million consumers. As around 80% of livestock in India is owned by small and marginal farmers, which is also the livelihood option for 50% people below poverty line besides being the income source for around 30-50 per cent of the household, the very basic issue of poverty alleviation agenda of the government could be meaningfully addressed through livestock centric growth and development agenda.

From the time of one acre of land + one pair of bullock + one cow that defined a farm family, both crop and livestock sector has been growing steadily with needed shifts in farming pattern and procedure. Now a stage has come to ensure a growth rate of +5 per cent in cattle and buffalo, + 10 per cent in meat and poultry sector so as not only to provide the estimated animal product requirement but also to retain and encourage unemployed youth in animal husbandry sector. For this, technological package and policy frame for different producer groups *viz.,* zero input production system (ZIP), medium input production system (MIP) and high input production system (HIP) are needed to meet the demand and supply side requirements.

Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India in their vision document calculated the need of 20 g of protein per person per day in addition to protein sources from cereal and other sources. Out of this requirement, 50% *i.e.,* 10 g is targeted from milk, 20% *i.e.,* 4 g from each of meat and fish and 10% *i.e.,* 2 g from eggs. For this to achieve, milk production (@ 250 ml per day for non-vegetarian and @ 500ml for vegetarian population) has to go up to around 160 million ton from the present level of 100 million ton by 2020. Similarly, the requirement of meat and eggs are estimated to be to the tune of 10.58 million tons and 80 billion (@ 90 eggs per person

i.e., half the WHO recommendation) respectively. In other words, milk, meat and egg production has to increase by 60, 61.44 and 56.25 percent by 2020.

There is an indication that rapid urbanization, higher per capita income, increase in human population have fuelled the demand for livestock and poultry products which is indicated by the increase in household food expenditure from 21% to 25% in urban and 16.1% to 21% in rural households within the period from 1983 to 2004-05. In employment front, this sector employs 11.4 million people in primary status and another 11 million in secondary sector related to it and most of this population belongs to small, marginal and landless category who holds around 71% of our cattle, 63% of its buffaloes, 72% of small ruminants and 74% of poultry. The contribution of this sector to agricultural economy has also been impressive even during the Green Revolution period when major focus was on crop sub-sector. Dairy sector has remained the maximum contributor with 62-68% of total livestock economy.

A revolution in livestock sector particularly in the developing countries is the need of the hour in the new millennium as the production of milk in these countries need to be increased from 164 million metric tonnes in 1993 to 401 million metric tonnes in 2020 to facilitate per capita consumption increase from 39 to 63 kg. Similarly, the total meat (beef, pork, poultry meat) production needs to go up from 170 mmt in 1993 to 353 mmt in 2020. The growth in developed countries however is expected to be negligible as evident from a projected annual growth rate of 0.4% in production and 0.2% in consumption. Basic issues for a livestock revolution in India among developing countries centres around following projections :

- Total population of India will exceed 1.3 billion by 2020- Provisioning of food of animal origin to them
- The population over 60 years of age will double from 60 to 120 million people- provisioning of value added animal products to them
- Technology support to 60% of small holder farmers for quality product preparation
- Facilitating shift from population driven to technology led growth and production particularly in the context of climate change and deficiency in feed and fodder

India ranks next only to New Zealand in cost of production of milk. The low cost of production is in our favour to compete in the international market. The issue of safety and quality of animal products adhering to SPS measures will have to be addressed on priority if India is to capitalize on livestock products centric trade globally. Good management and good manufacturing practices will have to be integrated in the production system to improve quality.

In order to be competitive, research output shall have to be programmed in such a way that it finds its inclusion in the development strategies. It is observed that in India, the research and developmental agencies work almost in their area domains in isolation because of which the ultimate client base is not benefited. For a technology led growth, a synergy between the two is a must. While the already developed technologies need to be adopted and taken by the development agencies, the research institutions shall have to focus on the following for generation of technologies to suit the upcoming challenges and situations in Animal Husbandry sector.

Researchable issues

- o Molecular Genetic Signatures for indigenous AnGR and conservation of threatened breeds
- o Development of quality genetic resource for optimum production targeting
- o Markers aided selection program
- o Assessment of embryonic losses and improvement in reproductive efficiency
- o Buffalo, Goat and Poultry genomics
- o Stem cell research for rapid multiplication of elite germplasm and novel veterinary applications
- o Improvement and utilization of low quality roughages through *in vivo* and *in vitro* biotech manipulations
- o Reduced green house gases from livestock and facilitating their adaptation to impending climate change.
- o Clinical Nutrition
- o Continued efforts to develop diagnostics and immuno prophylactics for various diseases using biotech & nanotech tools

- Pharmaco-genomics & dynamics for new generation drug formulations
- Targeting disease resistance genes in indigenous livestock and poultry
- Transgenic chicken and pigs for pharmaceutical production
- Animal waste disposal and residue analysis of environmental and industrial pollutants
- Development and improvement of processing technologies for value addition ; shelf life enhancement, quality assurance and packaging of livestock products
- Designer / dietetic livestock products to tap consumer preference
- Production of environment friendly animal with increased productivity
- Encashing neutracutical qualities in indigenous livestock
- Livestock for alternate source of energy
- Organic livestock and poultry production
- *In utero* selection of elite germplasm
- Development of seminal plasma protein based kits to identify elite animals
- Ration balancing for High value animal production
- Rumen biotechnology for improving the bioavailability of nutrients
- Allele mining for heat tolerant genes

In addition to these issues, a strong Market intelligence report gathering group on the demand side of processed products and strengthening accordingly the supply side technology innovation in order to compete with the high value product trade needs to be put in place. Human Resource Development to take on the cutting edge research in frontier technologies also needs to be given adequate attention by constantly reviewing the course curriculum including skill oriented training to the faculty members.

Policy Issues

It is important that some policy issues concerning Animal Husbandry Sector Development in the country are re-looked at. The poor attention to this sector both in terms of financial resources and input provisioning is basically due to the fact that decision making persons from Animal Husbandry Sector is not available; for example, research decisions are taken by an agriculturalist in the form of DG, ICAR and development decisions are taken by bureaucrats in the form of Secretary, Animal Husbandry. This mismatch shall have to be addressed if the Govt. is interested to help the poor livestock grower and the livestock per se. However, some other policy issues of concern are indicated.

- Gearing up of research agenda and strengthening of institutions
- Capacity building in organized processing sectors to increase the volume for post harvest processing and value addition
- Policy frame on public-private partnership particularly in the areas of service delivery through quality inputs and technology validation and dissemination
- Revisiting post graduate course curricula so as to accommodate the indicated areas to produce drivers for bringing in the desired shift to livestock production
- A shift to peri-urban production system so as to enforce biosecurity, safety and quality food production linking the small holders in the production to consumption chain
- Arranging certification bodies for semen, embryos, vaccine, germplasm, feed and food of animal origin
- Generation of a data base on production based identification of quality animals across the zones as well as for quantifying livestock products to be ear marked for high value production separately for domestic and international market
- Setting up of a Livestock and poultry development board with required autonomy to oversee, monitor and fund quality research and extension programme in this sector

Summing Up

With 485 million livestock and 496 million poultry which is almost equivalent to the human population, India has the potential to become a big global player in the production and trade of livestock products without affecting the interest of the vast majority of small holder producers.

Vice Chancelor, Assam Agriculture University, Jorhat

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Livestock Towards Livelihood of Small Farmers in India

Dr Purvi Mehta Bhatt

Dr Ian Wright

In India, of the 72% of the rural population, 57% of the households ((over 100 million)) keep livestock as their only or important source of livelihood. Many of these (32%) small-scale livestock keepers have no access to land and are dependent on livestock as the only source of livelihood and the number of rural landless households is likely to increase due to further subdivision of land holdings. Livestock are thus becoming an increasingly important source of income for smallholders and the landless. Women, in particular, depend on livestock, that is 76% of total workers engaged in livestock are women compared with 37% in cropping agriculture.

According to the Central Statistical Organization (CSO), the value of output from the livestock and fisheries sector was around $62 billion during the Indian Financial Year 2006/07. The livestock and fisheries sectors together contributed 31.7% to India's agriculture production value (value of output) and represent 5.26% of total GDP. In absolute terms, their contribution increased from 256 billion Indian Rupees (INR) in 1970/71 to INR 934 billion in 2002/03 (at 1993–94 prices) at an annual rate of 4.3%, higher than the growth in the agricultural sector as a whole (2.8%). While with industrialization, the contribution of agriculture to GDP is decreasing it is important to note that the contribution of the livestock sector to agricultural output is increasing: presently livestock contributes over 25% to the agricultural sector output, up from 16% in 1970/71.

Changing Markets/Demands

As in most emerging economies, the demand for livestock produce in India is increasing due to economic growth and urbanization. In the past two decades, for example, milk consumption has increased by 30% and total consumption of animal food products almost doubled between 1983 and 1999/2000. Importantly, these increases are seen across a broad range of income groups and in rural as well as urban areas. The increasingly integrated global markets under WTO are also creating opportunities for exporting animal food products.

The phenomenal growth in the dairy and poultry industries is well recognized, but the increasing demand for livestock products does not stop at milk, poultry meat and eggs. Demand for mutton and pork is growing too. For example, the increased demand for pork has pushed prices up by about 20% in real terms in the NE States in the past 5-6 years – good news for the many smallholders who keep a few pigs in their backyards. The opportunities for commercial production of goat meat are good in many areas of India but so far little attention has been paid to commercialization of small ruminant production.

Key Challenges Affecting Small Scale Farmers Engaged in Livestock Sector

Despite its significant contribution as a source of livelihood, nutrition and its contribution to the national economy in India, the livestock sector has not received adequate attention and investment, especially when compared to agriculture sector. The following section highlights some key policy and capacity development needs of the sector.

Policy

India has no overall livestock policy, although a draft policy has been discussed for many years and one or two states developing their own livestock policy. Development of the livestock sector has been largely

Table 1: Employment in livestock sector by farm category

Farm category	Agricultural employment in rural employment (%)		Share of livestock in agricultural employment (%)		Share of women in livestock employment (percent)	
	1993-94	2004-05	1993-94	2004-05	1993-94	2004-05
Landless	62.8	62.5	5.5	2.3	68.0	97.2
Marginal	73.0	65.2	7.1	9.2	69.4	73.4
Small	89.4	88.2	6.1	7.4	72.1	82.1
Medium	92.2	90.8	6.8	7.8	72.8	83.1
Large	93.1	91.4	7.7	8.6	76.7	82.0
All	78.4	72.7	6.8	8.8	70.5	76.6

Source: NSSO [National Sample Survey Organization] 2006

focused on diary development because of its role in nutrition and its importance to small farmers. But there has been limited recognition of the potential role of other livestock sectors in rural development and poverty reduction. The livestock sector could be assisted generally and be more conducive to small scale farmers, if policies considered the following factors-

§ The first requirement is for stable and reliable market systems for livestock products. As the majority of livestock farmers are small-scale and resource poor, marketing of their produce is one of the biggest challenges. These farmers need support for better access to markets, storage and transfer of their produce. Policies to encourage dissemination of market information and to help farmers to come together for collective actions would be useful. While dairy cooperatives, in some states, have been very successfully implemented, this has not been universal and other forms of market organization need to be explored. These need to go beyond the dairy and incorporate other livestock products. The policies must also recognize that most livestock products are traded through informal markets and provision of support to these markets and agents can improve their effectiveness.

§ Although market demand is the key driver, input supplies and services need to be provided and this is still a key bottleneck in the Indian livestock sector. In comparison to the crop sector, livestock extension services and inputs supply chains are generally very weak. A large part of the increase in output from livestock in the past has come from increase in animal numbers. This is not sustainable in the long run and the focus now needs to shift to increasing productivity per animal, which will require better feeding, breeding and veterinary care. A recent review of livestock services in India by ILRI and partners has pointed to the need of encouraging private sector and public-private partnerships in livestock services. In addition to feeding, breeding and veterinary services, knowledge of animal management practices and business development services including credit and risk-mitigating mechanisms in the form of livestock insurance need to be promoted. While government has a role in facilitating these services, it need not be the front line provider but it must provide an enabling environment within which others service providers can operate effectively.

§ Livestock, like other agricultural sectors, is a state subject and therefore each state has its own set of rules and regulations. The contribution of livestock to livelihood support varies considerably between regions and types of farmers and communities. A 'one size fits all' policy will not work and tailor-made policies in each state for different agro climatic

regions and different types of livestock producers are needed.

§ Some important elements of the livestock sector, for example backyard poultry, remains to a large extent unorganized. This kind of livelihood activity is particularly for poor and disadvantaged communities (90% of back yard poultry holders in Orissa, for example, are landless farm households belonging to scheduled castes and scheduled tribes). Policy interventions to organize these kinds of sectors would directly benefit underprivileged farmers and help them tap the growing demand for livestock products.

§ Improvements in value addition are necessary to sustain expanding markets, strengthen exports and counteract the threat of cheap imports. This will require public investment in infrastructure and in enhancing skills to ensure better returns for producers. Encouragement to private sector investment is also needed.

§ Policy interventions are needed to improve the credit flow to livestock sector and strengthen insurance support, especially to small livestock producers as to enable them to diversify into livestock production.

§ Appropriate policy and incentive structures are need to attract both public and private sector investment in the livestock sector. Identifying and facilitating clear roles for the public and private sectors and establishing strategic public-private partnerships will be crucial for tackling the present underinvestment in livestock sector.

The Planning Commission has designated a financial assistance outlay of $2.04 billion for the Department of Animal Husbandry, Dairying and Fisheries (DADF), Ministry of Agriculture under the eleventh five-year plan (2007-2012). This aims at achieving a cumulative

growth target of 5% for the dairy sector and 10% each for the meat and poultry sectors. While this is a welcome step, there are evolving policy needs in the context of changing demand, changing market scenarios, globalization, improved technologies and improved understanding, through research of various environmental and climate change issues. With an enabling policy environment there is considerable scope to extend the benefits of this sector to small scale farmers, who are the core livestock producers of the country.

Capacity gaps

With 485 million livestock and 489 million poultry, India ranks first in global livestock population. However the average productivity per animal is low, due to a significant gap between potential and actual yields. There are some significant capacity gaps in terms of research, infrastructure and access to technologies.

Table 2. Productivity per animal

Commodity	Productivity (kg per animal)
Milk	
Cows	1249
Indigenous	719
Cross-bred	2350
Buffalo	1570
Meat	
Buffalo	138
Beef	103
Mutton and lamb	12
Goats	10
Pigs	35
Eggs (no. per bird)	
Indigenous	112
Improved	258

Sources: Basic Animal Husbandry Statistics and FAOSTAT

Research/ Technology Generation

The emphasis in animal health research has largely been focused on curative treatments with preventive measures having been largely neglected. This area needs investments in terms of technology development and programme implementation. Research on cost-effective delivery of programs needs to be strengthened by bringing together epidemiologists and economists – animal health economics research is almost non-existent.

Achieving higher levels of production requires more than the feeding of crop residues. Smart ways of providing cost-effective supplements to locally available feeds need to be developed in which better nutrition is provided to selected animals at key times in the production cycle.

Improved genetics will be important. Most efforts have been focused on developing cross-breeding schemes and there have been some notable successes in some parts of India. But AI services still reach only about 10% of the dairy population. While crossbreeding can lift milk yields, there is also a need to explore programmes for improving existing breeds which often show adaptive traits suited to local conditions.

Changes in the way livestock products are procured, processed and retailed will place new demands on product quality. Production and marketing systems suitable for smallholder systems will need to be developed, if small scale producers are not to be squeezed out of the market.

Livestock farmers, especially women, have very rich, untapped indigenous knowledge on livestock production, including health remedies. This knowledge needs to be studied, recorded and strengthened by adding scientific knowledge to it.

The key to the development of successful programs and projects for livestock research is to develop the appropriate partnerships involving those responsible for the implementation of livestock development or development of policies in the research process and to recognize that research is only one component in the process of innovation.

Infrastructure

Livestock output worth Rs.432 billion (at 2002–03 prices) is lost annually, due to lack of infrastructure. This can be reduced through appropriate investment in transportation, storage facilities, processing, packing etc. requiring the public and private sectors to work together.

Technology and Service Dissemination

By encouraging the private sector, government can use scarce resources to target more marginal areas and communities which are less attractive to private companies. Government can provide funding, while NGO's or even the private sector provides the services in innovative public-private partnerships. A key component of successful extension is the provision of advice and services in an integrated manner - complete packages that deliver information on breeding, feeding and health coupled with business support services in an integrated way. This needs staff with a comprehensive understanding of livestock and its role in farming systems and this in turn has implications for the way in which professionals are educated and trained.

Conclusion

For the sector to achieve its true potential there is a need to strengthen the policy framework, develop innovative market models, invest in infrastructure and capacity development including re-vitalizing input supplies and services and needs-based research programs at national and regional levels. This will only be achieved through the combined efforts of all stakeholders in the livestock sector. With such a framework in place, livestock can provide an important pathway out of poverty for millions of people in India who depend on livestock for their livelihoods and will support the idea of *'Sarvodaya'* (rise of all).

International Livestock Research Institute

Reinventing Indian Traditional Milk Production system For Healthy Human, Animals & Environment

Dr MJ Saxena[1] and Dr Anup Kalra[2]

In India, our ancestors have been practising sustainable agriculture maintaining a healthy balance of crop, livestock production & soil health. The farmland is tilled using the human and animal power for optimum agricultural crop production. The grains harvested provided food security and the leftover crop residues served as animal feed. In turn, the animals returned the favor to the soil in the form of dung, which is a natural way to enrich soils with vital nutrients. The livestock produce/milk produced was most nutritious next only to mother's milk. Moreover, this activity provided a source for additional income to the rural household.

As the demand for milk increased, the traditional knowledge of milk production met with several departures. Though this resulted in increase in milk yield, it ran into major problems of pesticide & antibiotic residue. The West recognized these problems & adopted newer techniques or organic milk production.

During 1960 or 70's, Indians were already practising production of milk which the Western world reinvented & named as organically produced milk. This may be a new concept for the Western world. But for us it is our age old traditional knowledge of livestock production. As far as organic or quality milk production in our country is concerned, our ancestors had practiced the same for the past several years. Maybe we did not name it as organic milk. The organic milk is definitely safe, tastier, healthier & safer.

Milk Production in India

We trumpet that we are the largest milk producer in the world. But the fact is that this highest milk production figure is a mere 3% of the total world milk production, and our cattle have the lowest productivity in the world. The highest milk production in the world is from the largest herd population which is 30% of the world. We have 57% of world's buffaloes and 15% of world's cows. The average milk production of Indian cattle is thus about 1/10 of the world's average milk production. The demand for milk in India is expected to grow at the rate of 10% per year. The shortfall of milk in the Indian market is being made up by import of skimmed milk dry powder. The world milk prices are likely to shoot high owing to the demand in the market.

Organic Dairy Farming

The books define organic farming as a modern, sustainable agriculture system which maintains the long-term fertility of the soil and uses less of the earth's finite resources to produce tasty and healthy food. It is a balanced system that ensures soil, plants and animals enjoy the best conditions for development and growth.

Health Benefits of Organic Milk

Organic milk has all the nutritional goodness of non-organic milk but, due to the cows' more natural diet, it also has some additional health benefits.

" Omega-3- Fatty acids

Organic milk is naturally higher in certain nutrients than non-organic milk. One such nutrient is Omega-3-Fatty acids. Omega 3 fatty acids are essential for maintaining a healthy heart, supple and flexible joints, healthy growth and strong bones and teeth. This is due to the fact that organic cows are fed higher levels of natural red clover than non-organic cows. Further research shows that organic milk contains up to 71% more Omega-3 than non-organic milk and has a better ratio of Omega-3 to Omega-6 than non-organic milk.

" Vitamin E, Vitamin A and Antioxidants

Research has also established that organic milk has higher levels of

vitamin E, vitamin A and antioxidants. Organically reared cows, which eat high levels of fresh grass, clover pasture and grass clover silage, produced milk which is on an average 50% higher in Vitamin E (alpha tocopherol), 75% higher in beta carotene (which our bodies convert to Vitamin A) and two to three times higher in the antioxidants- lutein and zeaxanthine than non-organic milk.

" Conjugated Linoleic acid (CLA)

All milk contains conjugated linoleic acid (CLA), which is believed to boost immune function and reduce the growth of tumors. CLA levels are generally higher in organic milk, possibly because organic cows eat higher levels of grass hay and silage rather than concentrates. In fact, meat and dairy products from grass-fed animals can produce 300-500% more CLA than those of cattle fed the usual diet of 50% hay and silage, and 50% grain.

" Pesticides

Organic dairy farms do not use artificial pesticides (insecticides, fungicides or herbicides) on pastures where cows graze. It has been estimated that in the Western world, human bodies contain traces of at least 300-500 potentially harmful chemicals absorbed from our food. In the Indian context, this would be much higher. The use of increased chemicals since the Second World War, when farming became more intensive led to increased percentage of chemicals in the human body.

Some experts believe that children may be particularly susceptible to pesticide residues since they have a higher intake of food per unit of body weight than adults, have immature organ systems and may have limited ability to detoxify these substances.

Food	Total CLA (mg/g fat)
Homogenized milk	5.50
Butter	4.70
Ice cream	3.60
Fresh beef	4.30
Veal	2.70
Lamb	5.60

The rise in human fertility problems has been linked to pesticides. Five out of the 12 most commonly found pesticide residues are suspected to be hormone disrupting chemicals

Requirements of Organic dairy Farm

" Transition period

The transition period is for one year. Dairy animals must be transitioned (managed 100% organically) for one year. This is a one-time, whole herd conversion to organic. All animals must be managed organically from the date the transition starts.

" Land Requirements

It is recommended that atleast 90% of the land be certifiable before starting the transition process. Land must not have had any prohibited substances, i.e. synthetic fertilizers, pesticides, herbicides, treated seeds, sewage sludge, GMO seeds or inoculants, etc, applied for at least 36 months (3 years) prior to the harvest of an organic crop. Crops harvested from transitional fields must be completely segregated from organic crops.

" Feed Requirements

Dairy animals in transition must be fed 100% organic feed for a full year. This may be from fields that qualify for certification that are included in the Organic Farm Plan.

All feed supplements, including minerals and salt blocks must be approved. Antibiotics, GMO-derived products, animal by-products, urea, manure and synthetic preservatives are not permitted in any feed products. Mineral supplements must not contain prohibited ingredients (such as mineral oil and artificial flavors & colors). Use of treated seeds must be discontinued.

A Pasturing plan must be developed. All animals - six months and older - are required to be on pasture during the grazing season. Animals must get a significant amount of their forage from pasture during the grazing season.

Constraints of producing organic milk

" Feed

The feed & fodder which is given to the animals for feeding has high content of pesticides. In the given situation, it has actually become difficult to think of feed which is free from pesticides. Ayurvet has been working on the Hydroponics technology for the past few years & has now successfully developed a Hydroponics machine which can produce fodder upto 500kg/day.This fodder is safe, nutritious & pesticide free. The solution for pesticide free fodder, thus, is really the Hydroponics technology

" Recharging the soil humus

We had nearly 600 cows per 1000

Indians at the time of independence. Today this has been reduced to merely100 cows per 1000 Indians. In the past, milk sector recorded annual growth rate of 6%. However, the cow dung, which is devoid of chemicals & synthetic fertilizers, can be ploughed back as organic manure, into the agricultural fields, which would result in higher crop production. Organic manure strategies will complement the accompanied organic horticulture and other agriculture produce. There are immense domestic and export possibilities in production of organic products.

" Animal Health

The health of the animals is the key to success and higher economic development. For centuries, the traditional knowledge of Ayurveda has been used successfully to improve animal health & production. Some of the common problems which Ayurveda addresses are the areas pertaining to mastitis, retention of placenta, improving reproductive efficiency, tympany, and indigestion. Ayurvet, a premier Indian Company in herbal animal healthcare, with its rich experience with Ayurvet and scientific & clinical validation of its specialties offers the best solutions to these common problems & related issues of animal health.

" Extension work

Initiatives will have to be taken to educate the dairy farmers that prevention is better than cure. Use of natural medicines & their benefit demonstration in terms of animal health, fertility management, and mastitis control should be given top priority. These farms will be the new incarnation of the old Extension services. Unlike present Extension services, these farms will be participating in a productive cost center farming activity by making use of the best of scientifically trained manpower for their practical functioning. The best of modern Vet techniques of ET, AI, Breeding, cattle Nutrition and care strategies, specific to the particular geographic location will have to be practiced.

Indian Heritage & World scenario

According to SAN, the Sustainable Agriculture Network of USDA (United States Department of Agriculture) cow is the one important link in the chain of Atmospheric Carbon and Nitrogen balance cycles. The top six inches of soil is said to contain four times more carbon than all living plants, animals and the atmosphere. This carbon is locked in the organic matter in the soil. As the organic matter of the soil is depleted it becomes a source of more carbon dioxide in the atmosphere.

The depletion of organic matter and the accompanying release into the atmosphere of carbon dioxide is a significant reason for global warming than yet perceived, with all the importance being given to vehicular exhausts.

As a strategy to economize on cost of production of milk, New Zealand introduced scientifically well managed grazing systems for its cows. In Vedas, these grazing lands were called Charan and were not the same as pastures or Gochar. The milk from pasture fed cows turned out to be much cheaper and became more available in the market. The consumers not only found this milk cheaper but also tastier.

It was established by the scientists that only the milk and meat of the pasture fed cows contained high proportion of Omega3 and CLA (Conjugated linoleic Acid).

These constituents in milk played the role of providing protection and immunity from self degenerating human diseases, such as Cancer, particularly breast cancer, Obesity, Cardiac Artery Diseases, Diabetes, Arteriosclerosis etc.

This modern medicine research finding does not come as a surprise to us Indians, who have traditionally regarded a good healthy pasture fed cow's milk to be of immense nutritive and medicinal importance. We called it Amrit. Here we are not talking about the synthetically reconstituted white fluid which is being sold to the less informed Indian masses by the Dairy Industry and commercially promoted as the best nutritive milk.

Opportunity for Human Health and Rural Prosperity

In India, the production of milk has been consigned to the unorganized sector. The Dairy Industry that we talk of, is infact only a milk processing Industry. Fresh initiatives are now required to gradually introduce Dairy Farming in India to enhance our domestic milk supply.

Looking into the International standards, producing organic milk may not be easy at this stage but atleast certain initiatives may have to be taken to produce good quality milk for human health. This will only be possible when the animal health is ensured through the right feed.

Milk and cow can thus be utilized as the fastest and most cost effective methods to bring social change through health, wealth and prosperity of the nation.

Rig-Veda mantra says," Gav upavatavatam mahiyagyasya rapsuda , Ubha karna hiranyaya" .. RV8.72.12 where cows are well taken care of, the land remains highly fertile and productive. The people there attain well being and prosperity to wear gold ornaments in their years.

Conclusion

The production of organic milk in our country cannot be looked in isolation but should be in conjunction with soil, animal & human health. Initiatives should, therefore, be taken to educate the farmers & consumers about the benefits. It is well understood that the entire process may take time and be costly but first step in this direction will be a welcome step which will improve farm profitability, rural prosperity & overall health of the nation. Thus, it may be suggestive to find out a common path & adopt integrated approach of holistic development of man and society.

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Livestock and livelihood development

Dr VK Taneja

Importance of Indian agriculture and livestock transcend beyond its economic contribution as around 50% of total population depends on agriculture and allied activities for livelihood and household nutritional security. Though the share of agricultural sector in gross domestic product has declined over time, the proportion of workers engaged in it has declined marginally from 70.5 % in 1983 to 65.6 % in 2004-05. On the other hand, the share of non-crop activities (livestock, fishing, forestry, agricultural services, etc) during this period witnessed a downward trend. Their share declined from 11 % to 7.1%. Most of the decline in employment in non-crop activities is due to a faster decline in the employment in livestock sector. Livestock sector engaged about 8.5 % of labour force in 1983 which declined to 6.4% in 2004-05. This does not include persons in sale, reprocessing and transport of animal products at secondary market level. Females provide bulk of the labour force needed for various livestock production activities. During 1980s, 65 % of the labour requirement in livestock sector was contributed by females, and this increased to 71 % during 1990s. Against this the contribution of female labour force to crop production remained unchanged at 37 % suggesting that livestock enterprise is women oriented and growth in livestock production would help improve gender equity.

Growth potential with livestock sector: Livestock production and productivity has shown an improvement over the years. Livestock sector registered an overall growth rate of 3.6% during 1991/92-2005/06 (milk 3.9%, meat 3.2%, other livestock products 2.9%) against a growth rate 1.8% for crop sector. Similarly, the share of value of output from livestock to that of agriculture went up from 24.5% to 27.6%. Sustained growth in per capita income, fast increasing urban population and increasing awareness of nutrition-rich foods of animal origin among both urban and rural consumers suggest that livestock sector is sure to emerge as engine of growth of rural economy with potential to achieve higher growth rates of 6% per annum. Further, the growth in livestock sector is poverty reducing. This is evident from the fact that relationship between GDP due to livestock and poverty is negative thereby suggesting that augmenting income and employment in livestock sector through policy and technological interventions would help bringing down the incidence of rural poverty. The challenge, today, is to further improve the growth rates in livestock sector and make small holder livestock production a profitable, self sustaining and competitive venture while keeping in view the concerns of environment, bio-diversity, quality and food safety, human and animal health and animal welfare.

Production system and animal numbers: Although livestock is distributed across five major zones viz. hill and mountain, irrigated, rainfed, coastal and arid, major concentration of cattle, buffalo and goats is in rainfed and irrigated zones, sheep in rainfed zone and poultry in rainfed and coastal zones

Table 1: Distribution of livestock population across agro-climatic zones, 2003

	Arid	Coastal	Hill and Mountain	Irrigated	Rainfed
Human population (%)	2.8	13.3	4.3	35.0	44.6
Geographical area (%)	8.7	8.3	14.5	15.2	53.4
Livestock population (million numbers)					
Cattle	5.4	18.1	21.1	48.1	92.5
Buffalo	5.0	6.0	3.9	40.5	42.5
Sheep	7.3	9.9	4.9	4.3	35.1
Goat	8.9	10.39	11.2	37.3	56.5
Pig	0.2	1.0	4.7	3.9	3.8
Poultry	1.0	119.9	44.0	80.5	242.2
DM availability Kg/ACU/day	3.0(55%)	3.5(77%)	4.4(66%)	7.1(75%)	5.1(66%)
Productivity/year					
Milk yield (kg)	619	1,241	960	1,835	1,385
Wool (kg)	2.0	0.1	2.3	2.7	0.9
Average Rainfall (mm/year)	445	2,183	1,983	860	994

Source: Livestock Census, 2003; Figures in parentheses indicate contribution from dry fodder

(Table-1). Rainfed and irrigated zone account for larger proportion of livestock and human population and land area. Dry matter availability is highest in irrigated followed by rainfed zone. Between 55-77% of dry matter in animal diet consists of dry roughages. Non availability of grains, cakes and green fodder in required quantity is a major constraint in livestock production.

Livestock numbers in general have shown declining trends for all the species across all the major regions except sheep where substantial increase in numbers was noted in rainfed and coastal zones. In arid zone, small ruminants, the predominant species, are loosing out to cattle and buffaloes. These trends suggest adjustment of different species and stabilization of livestock numbers to available feed resources, production system and environment. Mixed crop livestock system is most predominant and practiced on 83% of the land while pasture based and industrial system account for 4% and 13% respectively. Food functions in animals are becoming more important than draft animal power and manure; these trends suggest that semi-intensive/ industrial production system would gain more importance in days to come.

Table-2: Distribution of livestock holdings in India

Category	Landless, <0.002ha	Marginal, 0.002-1.0 ha	Small, 1.0-2.0 ha	Medium, 2.0-4.0 ha	Large, >4.0 ha
%households					
1991-92	21.8	48.3	14.2	9.7	6.0
2002-03	31.9	47.1	11.2	6.2	3.4
Distribution of livestock, %					
Bovine					
1991-92	2.5	43.8	23.3	17.7	12.7
2002-03	0.6	51.3	21.2	15.0	11.9
Ovine					
1991-92	5.1	46.2	19.3	15.0	14.4
2002-03	2.1	61.5	15.7	9.6	11.0
Poultry					
1991-92	6.4	54.9	19.0	14.4	5.3
2002-03	4.4	62.7	17.4	6.8	8.6
Pigs					
1991-92	7.7	49.9	20.4	13.9	8.1
2002-03	3.2	76.2	12.0	5.5	3.0

Source: NSS Report No. 493, Livestock Ownership across Operational Land Holding Classes In India 2002-03, Ministry of Statistics and Program Implementation, GOI.

Rural households and livestock: Land and livestock are considered to be the major assets of rural households for livelihood support in general and small and marginal households in particular. Although, the proportion of landless households has significantly increased from 22% in 1991-92 to 32% in 2002-03, the share of livestock holdings among landless has declined significantly across all species of livestock (Table 2). Livestock production among landless households largely depend on common property resources such as grazing lands, water resources, forests, wastelands, fallow lands and roadsides for feed and fodder. The decline in availability of these resources has affected the landless households to quit livestock production. The increase in number of landless households could be due to disintegration of marginal households and larger availability of off farm jobs under various schemes of Government of India viz.NREGA etc. These trends clearly brings out that land is an important determinant for livestock production and size of livestock holding.

Although, the number of marginal households has remained around 48% overtime, the share of livestock holdings has substantially increased for all type of livestock (Table-2). Marginal and small farm households though are at subsistence level, these contribute a large part of milk, meat, wool and eggs. Around 70% of the total milk production comes from marginal and small households in small amounts as evident from the fact that only around 11 percent of the marginal and 16% of small households produce more than 2000 liters of milk per annum. Medium and large farmers though account for around 10% of households; these have around 27% bovine and 21% ovines.

Livestock in general and dairying in particular is a potential source of increasing income, providing self-employment and empowering rural women. This has been demonstrated through various studies including field experiments. Income from dairying as against crops in marginal (75.3% vs 24.7%) and small land holdings (54.10% vs 45.9%) in Punjab was higher than that in medium/ large land holdings (Table 3). In another study conducted by Punjab Agricultural University (2006), it was found that return over the variable costs was Rs 67768/ ha /annum from

crop-dairy farming as against Rs 30113 from crop farming. In other words, a farmer can have 56% more income from crop-dairy farming. As a result of higher income per unit of input, medium to large herds of crossbred cattle and high yielding buffaloes have come up in Punjab as an alternate to wheat-rice system. This trend is likely to continue and spread to other parts of the country and create more employment.

Constraints in livestock production: The major concerns with small producer are scale and efficiency of production as market costs both for live animals and livestock products are high being 20-30% of sale price in large ruminants and 15-40% in small ruminants. Providing small scale producers inputs, services, credit, market support and remunerative price is a major challenge. The other major production constraints were non-availability of quality animals, fodder seed, high cost of veterinary medicine and little value addition of livestock produce and their marketing. Currently only 15% of milk and 1% of meat in India is processed for value addition. This needs to be substantially increased through technological, policy and financial interventions and support. Unfortunately, inspite of higher growth rate and potential to increase income and employment, the public investment in animal husbandry and dairy development has been not only low but declined from 15% in 1991-93 to 5% in 2001-03.

Table 3: Income from crops and dairying across land holdings

Land holding	Marginal, <1 ha	Small, 1-2 ha	Semi-Med, 2-4 ha	Med., 4-10 ha	Large, >10 ha	Overall
%	18.7	16.7	29.3	28.0	7.3	100.0
Income, %						
Crops	24.7	45.9	69.9	79.4	80.7	66.5
Dairy	75.3	54.1	30.1	20.6	19.3	33.5

Source: Sidhu, R.S. and Bhullar, A.S. (2004). 'Changing structure of the livestock Economy in Punjab: Impact of livestock on income and employment patterns'. Indian Journal of Agricultural Economics, Vol 59 (3), pp 578

Intervention needed: Deficiency of energy and protein affect growth, production and reproduction. In order to optimally utilize the available feed resources, feed processing technologies like fortified fodder blocks, ammonia treatment and complete feed / total mixed ration for efficient utilization of crop residues should be developed and used. Reproductive efficiency is greatly affected by minerals in the feed. Area specific mineral mixtures should be used as part of the feed. Farmers need to be made aware about the advantages of complete feed and encouraged use of compound feed. Some of the diseases viz. FMD, HS, mastitis, brucellosis and parasitic diseases were mainly responsible for losses due to morbidity and mortality. Focus of the government should be on disease diagnosis and prophylactic management of important diseases through vaccination. Reduction in losses from diseases shall further improve economics of livestock production. Although breeding programs to improve quality of livestock exist, these need to be strengthened and managed on scientific lines so that quality breeding males and semen is produced as per the breeding policy requirement and made available to the farmers. Near absence of animal husbandry extension network is one of the main reasons for poor dissemination of technologies. Even the nutritional technologies for improving low quality roughages have found little acceptance in small farm production system because of poor demonstration of processes. The existing extension institutions have not been effective in delivery of technologies, processes and practices critical to support livestock improvement. The need is to develop an independent animal husbandry extension model for delivery of services and inputs at the farmer's door..

The problems of livestock production as related to infertility, improving digestibility of crop residues and improving diagnostics and vaccines should be researched on priority. The focus should be on producing cost effective technologies especially suited to small farm production system. Higher Government investments in animal husbandry infrastructure, development, extension and research would greatly help in exploiting the potential of livestock sector for providing food security, employment and increasing income from livestock production.

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Dairy Farming - Towards livelihood security of small farmers

Dr Amrita Patel

With an estimated milk production of about 105 million tonnes during 2007-08, India continues to be the largest producer of milk in the world. Over the last two decades, growth in milk production was about 4 percent per annum compared to a growth of 2 per cent per annum in population and food grains.

Milk is India's single largest agricultural commodity in both quantity and value terms, larger than even the principal cereal crops – namely rice and wheat. Although the contribution of agriculture including allied activities in the national Gross Domestic Product (GDP) has declined from 22.9% in 1999- 2000 to 16.3% in 2007-08 the contribution of livestock to agriculture GDP has increased from 23.1% to 25.6% during the same period, primarily due to growth in milk production as milk contributes to more than two thirds of the value of livestock output.

More than 70 million households are engaged in dairying, representing nearly 50% of all rural households, of which a majority of them are landless, marginal and small farmers.

The livestock sector which includes the dairy sector provides significant self-employment opportunities. As per the National Sample Survey Organization (NSSO) data (61st round - July 2004 to June 2005) the estimate of employment generated by the animal husbandry sector was around 11.44 million in principal status and 11.01 millions in subsidiary status which was 5.5 per cent of the total working population in rural areas. Out of the 22.5 million engaged in the animal husbandry sector 16.8 million were women, constituting 70 per cent.

There are some critical aspects which impact on livelihood security:

- Access to opportunities and stability in incomes
- Sustainability and long term growth prospects

Access to opportunities and stability in incomes

Dairying in India is scale neutral, since it is possible to produce milk with even one or two milch animals. Thus small producers are not disadvantaged as compared to larger size farms. It is for this reason that small producers continue to account for a major portion of the ownership of milch animals.

Small farmers with landholdings upto 2 ha. account for about 90 percent of households and own about 74 % of the milch animals.

On the other hand they operate only about 43% of the total area cultivated by rural households. As per NSSO data, small and marginal farmers with landholdings upto 2 ha. increased their ownership of milch animals from 68% in 1991-92 to 74% in 2002-03, indicating that growth in milk production did not lead to concentration of production in large farms.

The income from dairy constitutes nearly half of the total gross income for landless wage earning households, compared to only about one third of total gross income in the case of other households.

Dairying as an economic activity is more stable than crop farming for small farmers since the income from dairy farming is received in small amounts at regular intervals of time, unlike income from crops which is usually seasonal. Dairy farming therefore provides for an indirect insurance cover against risks such as crop failures due to calamities such as drought and pests. A milch animal also acts as a store of wealth, as it is an asset that helps to tide over unforeseen demands for liquidity.

Arid and rainfed regions account for 63% of cattle and 47% of buffaloes in the country as per the Livestock Census of 2003. This indicates that dairying contributes to stabilizing farm household income in such regions, where rural households face adverse climatic conditions and do not benefit from assured irrigation

or improved varieties of seed.

Sustainability and long term growth

Dairying in India is largely a low input output model, since crop residues and other by-products constitute the major portion of feed and family labour handles farm operations. This reduces the demand on natural resources such as land and energy, which provides the basis for a more sustainable growth for dairying.

Livelihood security in any economic activity is sustainable if the long term prospects of that activity are favourable. Owing to a rise in per capita income, the domestic market for milk and milk products is growing rapidly, which is indicated by the increase in the proportion of households consuming milk, in both urban and rural areas. Between 1987-88 and 2004-05, the proportion of households reporting milk consumption has increased from 62 % to 71 % in rural areas and from 79 % to 85 % in urban areas.

Based on growth trends in income and population, it is expected that the demand for milk would rise to about 180 million tonnes by 2021-22, at a growth rate of about 4% per annum. The additional milk production could contribute an additional Rs 45,000 crores (at current prices) of gross income to farmers. The long term prospects for dairying as a livelihood are therefore favourable, and would contribute to strengthening the livelihood security of small dairy farmers.

Even though dairying in India has made significant progress, it still faces a number of challenges. These include

- Remaining competitive
- Managing natural resources and climatic uncertainties
- Meeting feed requirements to sustain productivity
- Increasing coverage by institutional structures

Remaining competitive

Developed countries have strived to maintain competitiveness in dairying by securing productivity gains through increased scale of operations, relentless improvement in genetic potential and putting huge tracts of land for feed grains or pasture. On the other hand dairying in India has maintained its competitiveness, through a combination of appropriate feed and labour practices, which ensured that costs are kept to the minimum. Using crop residues and byproducts as feed and extensive use of family labour for farm operations ensure efficient utilization of resources that otherwise have limited alternative economic value. It is because of this that dairying in India is competitive in spite of constraints such as small scale of production, minimal capital and equipment, low nutritive feeds and a large proportion of animals with low productivity.

As a result of globalization, the volatility in international markets is increasingly impacting on our domestic market and thereby affecting the stability in prices. International markets for dairy products have significant distortions due to the prevalence of subsidies – both for production and export in developed countries such as EU and US. High levels of subsidies for production and trade continue to adversely impact on developing countries. Remaining competitive in such conditions will remain a key challenge for small farmers engaged in dairying.

Managing natural resources and climatic uncertainties

Soil fertility and quality, the availability of water and particularly the excessive loss of forest cover will have a major impact on agriculture and dairying in our country. 'Development' is leading to devastation of natural ecosystems and the country's ecosystems as a whole: large irrigation systems which are going out of use prematurely because of deforestation of uplands – mountains, hills and plateaus comprising 40 % of the country's geographical area; ill conceived irrigation leading to alkalinity and salinisation because the natural drainage systems have been irreparably damaged and because competition rather than cooperation has led to the overuse and misuse of available water resources in some areas leading to short term gain for some but with disastrous long term consequences.

The National Commission for Integrated Water Resources Management places the national water requirement for livestock at 5 billion cubic metres, and this is without accounting for water required for biomass, crop residue and cleaning. This is water for drinking alone! Besides quantity, quality of water is also a concern since increasing salinity has rendered water in several locations unpalatable and levels of fluorine are also surfacing as cause for concern in many parts of the country – Gujarat and Andhra Pradesh in particular.

Arid and rainfed region districts have a large proportion of the milch animals of the country. However ground water availability in these

regions is declining due to a combination of overexploitation and inadequate conservation measures. In the arid region, 14 districts out of 15 districts are either overexploited or in the critical and semi critical stage of exploitation of water resources and the same is the case for about 30 per cent of rainfed districts. The declining level of water availability is likely to affect feed availability as well as the risk of animal mortality, if they face sustained spells of drought.

Meeting feed requirements to sustain productivity

Between 1998-99 and 2005-06, the area under food crops in India declined by 3 million hectares from 131 million hectares to 128 million hectares, resulting in their share of gross cropped area reducing from 69 per cent to 66 per cent. The shift in cropping pattern from area under food crops to other commercial crops has serious implications on the availability of crop residues. To compound matters, prices of feed ingredients have been rising rapidly in recent years due to stagnant production rising demand and exports. The rise in prices of feed and fodder resources is likely to have a greater impact on small and marginal farmers engaged in dairy farming, since they are dependent on grazing lands and purchased feed materials. The rapid decline in common property resources (CPR) such as grazing lands is particularly a matter of grave concern.

Decline in availability and rise in prices of feed, therefore needs to be addressed urgently if we are to ensure livelihoods to small farmers.

Increasing coverage by institutional structures

Dairy cooperatives have made rapid strides in terms of membership, procurement and marketing of milk. Currently, the dairy cooperative network consists of 1.29 lakh village dairy cooperative societies with a membership of about 13.4 million milk producers, of which about 27 per cent are women. These cooperatives procured on an average 2.49 crore Kg of milk per day during 2008-09 leading to more than Rs. 10,800 crore per annum being transferred to milk producers in their village as payment for their milk. The dairy cooperative network thus supports the livelihood security of small dairy farmers, by providing regular access to markets for the milk produced by their members.

However, we face three critical and inter related challenges.

The first is that cooperatives are no longer the only major supplier in our milk markets. The entry of the private sector as well as multinationals in the milk business is no longer regulated. This is resulting in a slowing down of the earlier rapid growth of cooperatives.

Secondly, we need to ensure that larger numbers of dairy producers are brought in the main stream of our economy.

Thirdly, almost all the marketable milk surplus comes from 14 states. Today cooperatives reach only about 18% of the villages in these states and cover an estimated 17% of the dairy farmers. In the absence of accelerated growth, hundreds and thousands of small milk producers are likely to be left out of the cooperative domain and the ensuing benefits. To meet this challenge, NDDB is promoting the setting up of Producer Companies which are institutional structures that adopt the basic principles of cooperation, voluntary and unrestricted membership, democratic member control, participation of members in economic decisions, autonomy and independence, but which are registered as Companies. It is proposed that these Producer Companies which can also be considered as New Generation Cooperatives would be formed in areas where there is a need that goes beyond the capacities or will of existing cooperatives.

There is thus a need to promote a plurality of producer centric institutions under various legislative frameworks such as institutions set up as cooperatives or under the legal framework for Producer Companies or limited liability partnerships.

National Dairy Plan

To address the challenges of meeting t he projected demand for milk of 180 million tonnes by 2021-22, the NDDB has prepared a National Dairy Plan.

The Plan focuses on

1. Productivity measures, namely through breeding and nutrition, to enhance milk production as the average incremental increase will have to be 5 million tonnes of milk over the next 15 years,
2. Strengthening and expanding the infrastructure to procure, process and market milk through existing and new institutional structures.

These measures would not only provide for greater market access for small producers across the country, but would also improve the economics of dairying through productivity gains. Much of the increased milk production will result in additional incomes accruing to marginal and small farmers and landless.

Chairperson, National Dairy Development Board, Anand

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Services

Emerging Career Opportunities for Agriculture Graduates

Agriculture, the vocation that had lost its dignity over the years owing to the economic indifference it has cast to its stake holders, is now slowly gaining grounds in the light of corporatisation. Bygone are the days when agriculture was a matter of mere subsistence and a mode of survival for the poor. As the world itself has opened up gates and as many nations embrace a more liberalized economy, India stands to gain its share of benefits. Though the nation is still embroiled in the unabated farmers' suicide and numerous inequities existing in this sector, this profession has transformed itself and has attained the status of an enterprise involving the leanest and the mightiest entities in its fold.

A sector which was once primarily production driven has now significantly transformed in to a market driven enterprise that has all poised to become the next driver of the Indian economy. The Indian rural market holds a great promise for the future of India and so is the agri sector. More than fifty percent of the total retail market in India is held by rural retail. The growth of rural retail market has even outpaced that of the urban market and the corporate sector which once used to shy away from investing in rural development is today vigorously competing to invest and be a part of the over all development. Players of various hues such as agri input industries, agri machinery companies, processors, exporters, retailers etc are vying for their space in rural India. Many retail chains are now opting to enter into contract farming so that they could control the flow of produce from the initial stages itself.

Though the sector is booming with opportunities, the most pertinent issue of maintaining productivity and quality remains largely unanswered and unattended to. This sector is in need of a total revamp in terms of skilled or 'learned' manpower. Unfortunately, for educated people, agriculture sector is loosing charm and is failing to attract the talent, be it research, academic, extension or production related jobs. However, the agribusiness sector and the new emerging knowledge related businesses, provide more challenging opportunities for the educated youths, particularly where MNCs or large organized sector companies are involved. The growing agribusiness sector has the potential of providing a number of job opportunities which can only be catered more efficiently by students with agriculture sciences background.

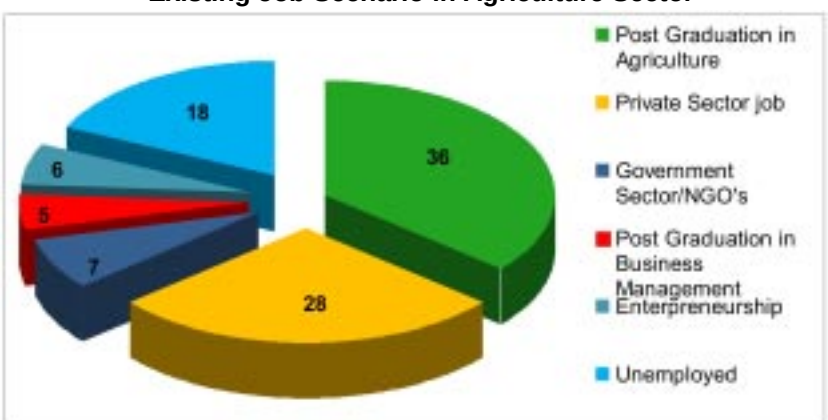
The Changing face of Agri Profession

Earlier, for a graduate or a post graduate of this discipline, government was the sole employment provider. Most of the work pertained to extension activities which were in fact more productive during the early seventies with T&V systems. The golden years of agriculture following the green revolution were golden period for the agri professionals as well. But gradually with time, their effectiveness wore out and so did the profession. The number of jobs with government either remained stagnant or the number of graduates outnumbered the actual vacancies. Whatever the reason, the jobs with government showed a declining trend and the graduates faced a grim future.

Mr MJ Khan

The government's increasing withdrawal from the production scene and the entry of private sector has thrown open several opportunities for the agri graduates in the corporate sector. The involvement of private sector, in the beginning was mostly with the input industries, such as fertilizers, seeds, pesticides etc., which still offer

Existing Job Scenario in Agriculture Sector



The National Scenario: Approx. 16,000 Agri graduates pass out every year 10 institutes and 24 SAUs

good number of job openings to agriculture graduates.

Seeds Industry

Seed industry for instance, is one of the fastest growing agri-input industries, ever since the entry of major corporates in 1988, when new seeds policy was announced. And now, with the increasing application of biotechnology, the pace of growth is likely to increase. The market share of the corporates in the prolific seed industry is a whopping 70 per cent, whereas the government involvement is limited to 30 per cent. The corporate sector mostly having tie ups with global big wigs have a very impressive growth rate and better organized to handle the demand pressures of the market. More importantly, their better working culture and pay outs create more opportunities for talents in the agri sector. With a 15 per cent growth rate and a turn over of Rs. 5000 crores, this industry accounts for the largest number of new job openings. In seed industry, an agri graduate can find job in Research and Development, production, product development, sales, marketing and procurement etc. The major players are Monsanto, Mahyco, Proagro, Advanta, Syngenta, Nuziveedu, Rasi, Indo-American, JK Seeds, Namdhari, Nunhems, Bayer, Bejo Sheetal, Ankur Seeds, Vibha Agrotech etc.

Pesticide Industry

Another preferred career destination for the agriculture and agribusiness graduates is the Rs. 6000 crore strong Pesticide industry, which is dominated by MNCs and other major corporates. In terms of job openings, career growth and compensation package, this industry has been on the top during the last two decades. There are a good number of agri graduates holding top positions in the industry today. Fresh openings are mostly in the sales & marketing areas. The preferred qualification would be B.Sc (Ag) or M.Sc. (Ag.), preferably with MBA. But for more specialized avenues, this sector requires candidates to be M.Sc. (Ag) or Ph.D in disciplines like entomology, pathology, agronomy, weed sciences and agriculture chemicals. The major players are Syngenta, Bayer, BASF, Cheminova,

Monsanto, DuPont, Dow etc. among MNCs and Rallis, UPL, Excel, Dhanuka, Gharda, Pesticides India, Crystal Phosphates, NACL etc. among Indian companies.

Fertiliser Industry

The largest input industry of agriculture is the fertilizer industry with a business size of approx. Rs. 50,000 crores. The industry however operates under tight Government controls with respect to investments, gas availability, output allocations and subsidies. They are comprised of Govt. sector, cooperative sector and private sector companies, sharing almost equal size of the market. The industry is deficient of fresh investments, as in the last 15 years, no new fertilizer plant has come up in India. For the openings in marketing and agriculture services, the preferred qualification is B. Sc. (Ag.) or M.Sc. Ag. in Agronomy or Soil Science and for marketing it is agriculture graduation with M.B.A. The major players in this industry are NFL, RCF, IPL etc. in Govt. sector, IFFCO & Kribhco in Cooperative and TCL, Chambal, Indo-Gulf, Coromandal, SPIC, DSCL, NFCL etc. in private sector.

Farm Machinery Industry

Agri machinery sector is also holding up tight among other industries. Unlike other sections, this particular sector has shown a keen interest towards the agriculture engineers or mechanical engineers, al-

though there are also some companies which have hired B.Sc. (Ag.) and agribusiness graduates. The tractor industry is comprised of some major names such as Mahindra, TAFE, Escorts, Eicher, HMT, Punjab Tractors, Sonalika, New Holland, John Deere, Bajaj Tempo etc. Apart from tractors, other equipments such as threshers, trolleys, cultivating equipments etc. are manufactured by mostly small sector companies.

However in the irrigations systems, manufacturers include some major names like Kirloskar, Jain Irrigation, Netafim, Plastro, Premier irrigation etc.

These industries also hold promise for many job opportunities for agriculture graduates. The launch of Micro-irrigation projects by States like APMIP in Andhra Pradesh, GGRC in Gujarat, Harit Rajasthan etc. have opened up large number of job opportunities for agriculture graduates. Under these projects, companies supplying MI systems are mandated to recruit agri graduates or agri engineers for providing services to farmers.

Farm Credit Industry

Rural credit, a crucial input for agriculture is mostly catered to by nationalized banks, cooperative banks, RRBs and other govt. institutions like NABARD etc. Agriculture graduates stand a great deal of chance of getting in to these kinds of institutions. In fact in 2008 - 09, public sectors banks were the highest recruiters of agriculture and agribusiness graduates in India. Moreover, many leading private banks like ICICI have increased their share of rural banking. So did many micro finance institutions. Thus the opportunities for the candidates with agri background in this sector have been on the rise. There is likely to be good growth in rural credit industry, as now concepts like Kisan Credit Cards, Online purchase crediting systems etc. are in place as also the general growth in demand for credit due to variety of factors, like increasing commercial approach to farming, involvement of corporate, diversification to high value crops etc..

The Prospective Areas for Agri Professionals

Apart from the conventional job opportunities, now the agri graduates are more likely to encounter more challenging and demanding jobs that too in many unlikely areas such as IT, biotechnology, food processing, cold storage, agriculture supply chain management among many others, which are offering tremendous opportunities. Also, the increasing role of NGOs and other developmental organizations in the rural scene have also created many opportunities where the agri professionals can prove their mettle.

Since the specifics of jobs are changing with market dynamics, the usual curriculum in many SAUs is insufficient. The concept of marketing and management which is non existent in the college curriculum plays a huge role in any progressive career that an agri graduate embarks upon. So a MBA becomes all the more necessary if one has the ambition to excel in the job.

The opportunities for agriculture graduates to acquire the knowledge of management concepts are limited with less than 1500 seats available in agribusiness management

institutes and SAUs against about an annual production of more than 16,000 agriculture graduates from SAUs and affiliate colleges. A post graduate degree in agribusiness management in this scenario can be viewed as a ladder to one's corporate career growth. The industry requires no less than 2500 agribusiness management professionals annually and as already discussed, we have a supply of only about 1500 only. A huge demand supply gap is resulting in sky rocketing salaries and a need is felt for producing more number of agribusiness management professionals to sustain the growth of the industry.

Apart from this, the knowledge of agriculture, agribusiness, market, products, competition, latest development in research, policy changes, new concepts in agriculture etc. is becoming more and more important, as the nature of business keeps on changing due to technological developments, corporatisation and globalization.

R&D is yet another area, which has been attracting considerable attention both from the government bodies and private sector. Although, the positions in the existing government bodies as scientists have a limit regarding the number, the glory attached to serving in some of the nation's premier institutions has never subsided. There is still breathtakingly high attendance to the examinations held for these coveted posts. The scenario is quite different in the case of the private sector where the close competition demands innovation, which can only be rendered by a sound R&D. So now, most of the input companies especially those in seed sector are giving impetus to the R&D. Hence those with research in their mind can try in the private sector as well. When research is the priority, the candidates have to expand their résumé with more qualification going beyond post graduation. A PhD and sometimes a post doctoral fellowship may come in handy to serve as a scientist.

Agriculture as a sector itself has undergone many changes and so are the opportunities associated with it. The near future will see more educational institutes in the agribusiness sector coming up to cater to the increasing demand for trained professionals for private sector. The corporates are also expected to step in with their participation to produce sufficient number of skilled and employable manpower in agribusiness. Various short term and long term courses, distance learning courses and skill enhancement training programmes are a definite yes in the days to come. The student community in agriculture has to look ahead and gear up to take the challenges of the unfolding world of agriculture and contribute to the larger growth and development of the nation. With trade and agriculture getting globally integrated and in post WTO scenario, the global opportunities are awaiting Indian agri professionals. There are also strong opportunities emerging for them to serve the millions of people living in the rural areas by participating in rural growth phenomenon, where corporates and institutions are aggressively involved.

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Agriculture Today, Krishi Today and Agri News Service

AGRIBUSINESS
DEVELOPING LEADERS OF TOMORROW

The concept of agribusiness has been dormant for quite time since independence. The very first initiative in this direction was taken by Indian Institute of Management, Ahmedabad by establishing Centre for Management of Agriculture (CMA) during the early 70's, followed by the establishment of an exclusive institute for rural management at ANAND.

Today more than a dozen reputed institutes/colleges including two Indian Institute of Management (IIMs), Ahmedabad and Lucknow and National Institute of Agricultural Extension Management (MANAGE), Hyderabad offer exclusive full time education programmes in agribusiness management, besides postgraduate courses in agribusiness by a large number of Agricultural Universities.

Any agribusiness education programme needs to look into different companies and stakeholders needs. The stake holders mostly include faculty-competent enough to develop and handle the curriculum; agribusiness and allied sector companies-covering different sub sectors *viz.,* finance, inputs, marketing, processing, trading, insurance, research, energy (alternative fuels) etc.; students-willing to take up work in agribusiness sector as career or as entrepreneurs and controlling authorities.

One of the major challenges for the institutions starting an agribusiness management programme is developing an appropriate curriculum. Institutions follow different processes and models for deciding the curriculum. Given the consumer oriented nature of agribusiness, the involvement of senior managers and executives at some level will become necessary in developing the curriculum. In the Indian context, the syllabus of agribusiness courses followed by various management institutions in general covers all fundamental management principles in the areas of marketing, finance, operations, human resource management and information technology. In the field of agribusiness, the courses include micro-finance and micro-credit, rural marketing, international trade in agri-commodities, agri-entrepreneurship, agri-input marketing, supply chain management, rural marketing, procurement management, agriculture finance, agribusiness risk management, emerging issues in agribusiness and food industry, commodity futures, agriculture project management etc. depending upon the needs of business skills & knowledge to be imparted to the students. Besides development of appropriate curriculum, there is an imminent need to have action research and writing of relevant cases in agribusiness field and testing their suitability for education purposes.

What Business Companies look for

- ❑ Honesty, sincerity, integrity and discipline
- ❑ Sharp business thinking/ intelligence
- ❑ Good self manager
- ❑ Understanding of rural life and problems of farmers
- ❑ Ability to handle subordinates, specially working in rural areas
- ❑ High intelligence & Emotional quotient
- ❑ Adaptability
- ❑ Conceptual skills/Soft skills
- ❑ Competitive nature with fairness & honesty in core. Have win-win attitude
- ❑ A good time Manager with ability to prioritize his/her activities
- ❑ Ability to handle ICT systems efficiently

For the success of professional education programme, the basic principle is its focus on preparing the students as per the requirements of business and industry.

What is actually needed is re-alignment of the course curriculum with more emphasis on ethics and Corporate Social Responsibility (CSR). The students are the future managers and therefore a glimpse of the CSR practices delivered will help to produce leaders to the society who can manage, lead, mentor and inculcate values and principles in the society.

Dr BDTripathi

Profile of an Agri-business Student

Profile of a typical agribusiness management student to become successful manager:

- ❍ Good knowledge of subject matter
- ❍ Focus on the objective to become a successful agribusiness manager.
- ❍ Have capacity to study / work minimum 14-16 hours/day.
- ❍ Open minded with capacity to absorb new concept
- ❍ Computer literate and technology savvy
- ❍ Language proficiency in English and urge to learn foreign language if desires to serve multinational companies.
- ❍ Interest to know latest in business world from TV channels
- ❍ Rural orientation about people, their profession, economy & their needs.
- ❍ Action oriented especially to complete the project and assignment ahead of deadlines.
- ❍ Initiatives to reach out for alumni in various organizations for enhancing, knowledge about needs of the industry.

Controlling Authorities

Today agribusiness education is in a state of growth. One important way to sustain this growth is quality education which will help to transform an agribusiness student into a dynamic manager / entrepreneur. The government institutions and universities need to have a strict vigilance on quality norms of teaching and avoid mushrooming of colleges, as have been in the case of engineering education in certain states which has led to excess seats with constrained faculty.

Director, MANAGE, Hyderabad

The Back Drop

Agribusiness-Past and Present

Time has come to go a step ahead of just repeating certain phrases over decades like “Agriculture is the backbone of the country”, “about 70% of Indian Population lives in villages” and so on. Let us now link agriculture with agribusiness in whatever we do or say within the realm of agriculture. At present, we can very well say that “Agribusiness has entered a new era”, marked by vibrant business activities; farming becoming hitech and technology directed; business becoming more global, farmers getting tech saavy, hitherto less heard business models in agriculture like commodity exchanges coming up in the country, business houses and entrepreneurs completely inactive in agribusiness even in the recent past currently showing interest in agribusiness, global slowdown pointing out at the importance of farming and farming sectors are some of the trends that is defining new contours in the country’s agribusiness sectors.

Technology and globalization is making agribusiness operations more competitive, tech driven, fast and trendy. Along with the entry of new players in the business from even previously unthought of sectors like IT, Telecom, FMCG and others, there has been an import of new culture of work style also. Also many of the family owned companies in agribusiness, with the next generation taking up the mantle, is undergoing a complete makeover in terms of work style and functioning in tune with the modern times.

Emerging Human Resources Requirement

All these indicate that agribusiness is witnessing a complete change and as a result, calling for new paradigms in human resource requirements for the sector. Gone are the days when a company in agribusiness sector could fulfill its requirements at its own pace, going to some renowned campuses, or placing adds in news paper or head hunting for even the smallest posts through employee referral or spotting an employee of another company performing well in the market and wooing him up to join the company.

With the advent of sectors like F&V retail business, cold chain activities, rural finances and diversification of various traditional companies from fertilizer, seed, agrochemicals business into other related business interests, human resource requirement in the present day for agribusiness companies has become very critical. Companies need quality manpower in the shortest time period. At the same time, there is increased competition, greater pressure, need for greater operational efficiency and greater focus on the core activities. Also, business groups from diverse sectors like IT, Telecom etc feel a need to know more about the sector vis-à-vis the right man-power availability and requirement aspects.

Is Cost Reduction the only Motive...Different Aspects of HR Outsourcing

While outsourcing various HR functions to independent third party vendors, an organization, apart from cost reduction and focusing on its core activities,

- **Consultant capabilities and talent:** On many occasions, a company would like to utilize the domain knowledge and expertise of the vendor in a cost effective way through outsourcing its strategic core activities in HR.
- **Functions Difficult to Manager:** Functions like that of benefits administration etc., are sometimes very cumbersome, difficult and time taking for an organization. Moreover, these activities in no way contribute to the core activities of the organization. In such instances, an organization looks forward towards outsourcing these activities.
- **Specific Technologies:** Many a times, companies offering outsourcing services in HR activities possess certain technologies specific for the purpose. Owning these technologies make sense in case there is a very large clientele and regular requirements like that of the vendors of HR outsourcing. However, they make less of any economic sense for an organization for its own manpower management. In that situation, it looks forward to outsource.
- **Resources Not Available Internally Within the Organisation:** In many cases, certain resources like that of a database or pool of trained manpower or networking capabilities etc of a vendor is eyed by an organization and HR activities outsourced to utilize those resources.
- **Asset Transfer:** In some instances, outsourcing deals

Pinaki Ranjan Dey

help a company to transfer some of its assets-some or entire part of specific assets, to the vendor. It can even encompass transfer of some of its staff.

Domain Knowledge and HR Outsourcing in Agribusiness-The Need Analysis

Other than the advantages of any general outsourcing activities like saving of cost, focus on core business activities and others, some of the specific advantages of outsourcing HR activities typical to the agribusiness sector are:

- Typical nature of Agribusiness: Agribusiness is quite unique when compared to other business sectors. The supply chain aspects are quite complex - presence of unorganized players within the ecosystem of agribusiness, requirement of a lot of business acumen along with technical knowledge about agricultural sciences along with a fair degree of uncertainty in the business from the point of view of vagaries of nature, seasonality of production, perishable nature of products etc. All these calls in for maximum operational efficiency for the organization in agribusiness with minimizing risk at each aspects of operation including manpower management. Due to seasonality of production and also business intensity, manpower requirement fluctuates between various seasons and many organizations considers temporary staffing as a convenient method of utilizing human resource most productively and cost effectively.
- Requirement of technical knowledge: Agricultural science includes diverse fields from genetics and plant breeding, entomology, pathology to economics and extension. The agribusiness in the same way categorises itself with operations requiring manpower from these diverse fields of agriculture sciences. Along these, one requires a right blend of IT exposure and business acumen. As a result, the selection process of a right candidate for a particular job depends on the true understanding of the job description rightly understanding its technical words, knowledge of the right terminologies and synonymous keywords, rightly understand the synergies and the variations between different sub sectors within agribusiness sectors. In short, proper understanding of these aspects would largely determine the right evaluation of a prospective employee and the management may not always afford to do that at every step in order to save their time for focusing on more core activities. They then would like to outsource these activities to organizations specialized in agribusiness sector or having long presence in agribusiness sector with qualified technical people.
- Bulk Recruitment Activities: Sectors like retail industry on various occasions requires a large manpower in a very short time. They would in such a situation like to outsource the recruitment function to some organizations dedicated to the agribusiness sector. Understanding the rural economy as a backdrop of agribusiness is quite crucial in understanding company's manpower requirements. For functions like procurement in retail operations, one needs to understand different aspects of agri supply chain, interaction with farmers and sensitivities and intricacies involved in dealing with the rural ecosystem. An organization having familiarity with these aspects tend to find and source the right candidate in shortest possible time to the clients, there by saving time and money for the client.
- New Entries In the Market and Need to Convince Prospective Employees: New entries can be in terms of entering a new geographic area, an established company in some other sector diversifying into agribusiness, an established company in agribusiness entering into a another related business, entirely a new startup or a multinational in agribusiness starting operations in the country. All these types of companies would like to outsource their recruitment and different HR activities to some recruitment agencies specialized in agribusiness. Usually, for new entries, unless it's a huge multinational or a big business group, prospective candidates seeks information in terms of their future prospects and career growth. A detailed domain knowledge, awareness of the technical aspects of agriculture sector along with clear understanding of the future trend of the sector helps to guide a candidate in the right way and incite further interest in the company as a prospective candidate.
- Head Hunting for Senior Positions While Maintaining Secrecy: Sometimes, in the buildup of replacing a senior level position of any organization, secrecy is maintained for various organizational and operational reasons and generally preferred to be done through some consultants. Extent of domain knowledge and networking in the agribusiness sector in such a situation helps in sourcing the right candidate in the shortest possible time through head hunting.

HR Outsourcing in Agribusiness-A Win Win Situation For All

Outsourcing some functions of HR activities like recruitment and staffing is in no way replacing the internal HR team of an agribusiness company. While the internal HR team of a company takes care of various important activities of human resource development within the company along with various

corporate social responsibilities coming up in big day now-a-days, it has the luxury of getting a specialized service of a third party providing its recruitment needs through sourcing the right candidate utilizing its domain and technical knowledge in agriculture sciences and agribusiness.

Issues and Challenges in HR Outsourcing in Agribusiness

- **Shortage of skilled manpower:** One of the major issues in the sector is the shortage of people who know the nitty-gritty of agribusiness as well as the operational areas and skills of human resource outsourcing functions. As the HR outsourcing industry in agribusiness is still in a nascent stage, agribusiness professionals and agriculture graduates are not much aware of the career opportunities in this sector.
- **Existence of many unorganized players:** HR outsourcing sector is marked with many unorganized players, sometimes even by individuals operating from their living room, particularly in the recruitment activities. These unorganized players can operate on a very small margin. However, HR consulting is sometimes more than just networking and having contacts with people. It requires a lot of involvement and investments in terms of databases, market research, extensive calling and traveling which is possible for organized player with a definite setup, having offices in various locations, manpower and investment cost.
- **Disconnect between industry needs and curriculum offered by institutes:** Unfortunately, in our country, in the agribusiness sector like many other sectors, there is a great disconnect between what the industry needs and what the institutes engaged in agricultural sciences offers. The course curriculum and the mind set are very academic and theoretical. Industry wants readily employable candidates who require far less training. This sometimes becomes a major hurdle in the way to sourcing the right talent.
- **Inherent Risks of HR Outsourcing:** There are some risks associated with the HR outsourcing activities like candidates not joining at the last moment causing a lot of inconvenience to the companies. Also, on some occasions, positions are scrapped at the last minute by organizations causing a loss to the outsourced company in terms of man days worked on.

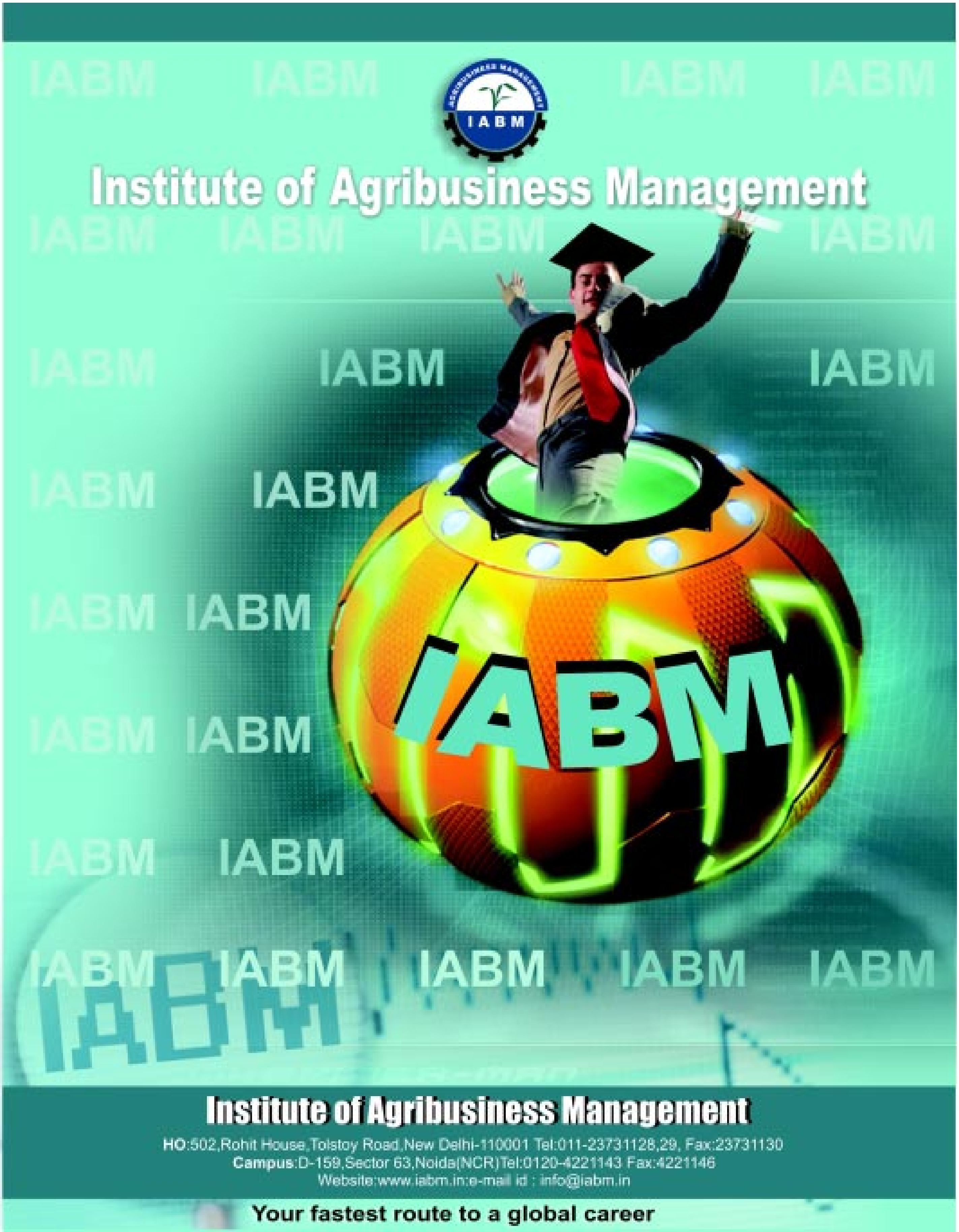
Important Growth Drivers of HR Outsourcing in Agribusiness

- **Booming Agribusiness:** In the recent years, inspite of the current recession, agribusiness as a whole is growing unlike their contemporaries in the sectors like IT, exports, Banking etc. Many of them have ambitious expansion plans too. Despite the recent issue of scanty monsoon rains all over the country, it's expected that many of the companies would go on with their expansion plans. They would require man power for that and would like to outsource most part of that.
- **Increased Competition and Decreasing Profit Margins:** Competition in some of the agribusiness sectors like agri inputs has increased significantly. A lot of consolidation, more globalization etc., has resulted in reduced profit margin. As a result, organizations are willing to outsource supporting activities like recruitment in a cost effective manner so as to increase operational efficiency and concentrate more on their core activities.
- **Some Big Names in HR Outsourcing into Agribusiness:** Many of the big names in HR outsourcing hitherto consulting predominantly for sectors like IT, Telecom, Healthcare etc are now eyeing the agribusiness sector. Certainly, this would tend to drive the HR outsourcing activities further.
- **Entry of various MNCs into Agribusiness:** Though many MNCs are present in India, many other companies from overseas are entering the country in sectors like retail, food processing and others either directly or indirectly. They would like to expand very fast, recruiting a number of people in very less time. Consequently, they tend to outsource recruitment functions.

Conclusion

The flavour of HR outsourcing is picking up in agribusiness. Many of the organizations are increasingly realizing the benefits of having a combination of outsourced and in-house HR activities, a mix whose proportion depends on the size of the organization. However, one should understand that like any other service industry, one of the critical success factors of HR outsourcing service is the mutual trust and confidence between both the companies and the vendors. The relationship should be one of a kind of strategic partners than mere client relationship. Companies should select a vendor on the basis of providing the maximum returns, sometimes not only in terms of direct cost savings but also from the point of view of several long term benefits. On the other hand, vendors should have a proper understanding of the clients needs, their organizational culture and should always aim at providing the maximum returns, stretching that extra mile.

Head-Research and Studies, Concept Agrotech Consultants Limited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Major Initiatives

The 20-20 Model

Higher Farm Production with Lower Input Cost

There is a great need to reduce the input costs and at the same time improve the farm productivity in a sustainable manner. A model has been worked out- based on a number of field demonstration studies in different parts of India, Africa and far eastern countries. A model in which input cost can be reduced by nearly 20 percent and at the same time the crop production can be enhanced up to 20 percent is possible and can be a boon to farmers in most parts of the world. This is the model, which can be easily adopted in an evolutionary way.

Among 8 millennium goals, eradication of poverty and hunger and environmental sustainability are perhaps the most prominent and complimentary. The Green Revolution changed India from (& some other countries') being food deficit to food sufficient / surplus state. Time is now for a new and Sustainable Revolution.

If we look at the challenge that agriculture sector has to face during the next few decades, it is clearly to double the food production by 2025 and triple it by 2050 on less per capita land, with less water and under environmentally challenging conditions.

Let us look at the current scenario and some major developments.

- Indian farmers spend nearly Rs.2 lakh crores on inputs like seeds, fertilizers, pesticides.
- Nearly Rs. 50,000 crores goes as fertilizer (chemical) subsidy.
- Excessive use of chemical fertilizers in India has reduced soil ferltility and food production (Green Peace & Vishwa Bharti report – 2009). Fertilizer use efficiency is drastically declining. (It has already come down from 19 kg food-grains per kg fertilizer in mid-60's to 12 kg/kg in 2007.)
- Our soils are hungrier for organic carbon. The carbon transfers and transformations at the soil or even the cell level can delineate the other nutrients such as N, P, S, etc. that become available to plants and microorganisms.

There is now a better understanding of Multi Microbial Consortia technology which can substantially improve crop productivity and at the same time reduce the agrochemical input costs. Further, new method of preparing high quality Biocompost from agro-wastes, FYM, etc. can greatly improve the availability and quality of nutrients of assured standard and much needed Carbon to the soil. Another startling development has been in the area of pesticides. In January, 2009, the European Council passed the Council Directive 91-414 banning nearly 45% of the prevailing chemical pesticides. This will have great impact on the overall world agricultural scenario. As a matter of fact in 1993, nearly 740 active ingredients were available in European market whereas on August, 2008 nearly 394 of those were not allowed and 113 more are under review (FCI-Dec., 2008). Two major classes of fungicides at risk are triazoles and dithiocarbonate. Triazoles are main weapon against *Septoria*- a major fungal disease in cereals. The Swedish Chemicals Agency, a Govt. organization responsible for a non-toxic environment was one of the first EU member to interpret the temporary criteria for endocrine disruption and published a 'Black List' of some prominently prevailing chemical pesticides.

All these developments point out to:

- An urgent need for eco-friendly and effective Biopesticides.
- Need for their availability at low prices and supply.

Fortunately several new/alternative developments offer much hope.

Range of bio inputs :

Broadly bio inputs range can be classified under three main categories :

i) Nutrient Management : Biofertilizers, Enriched Biocompost, Multi-microbial Combination of biofertilizers and biofungicides in the soils.

ii) Biopesticides : Multi microbial biopesticides, botanicals, pheromones etc.

iii) Growth enhancers: Amino acids, micro nutrients, seaweed extracts, growth promoters and hormones, etc.

Dr MH Mehta

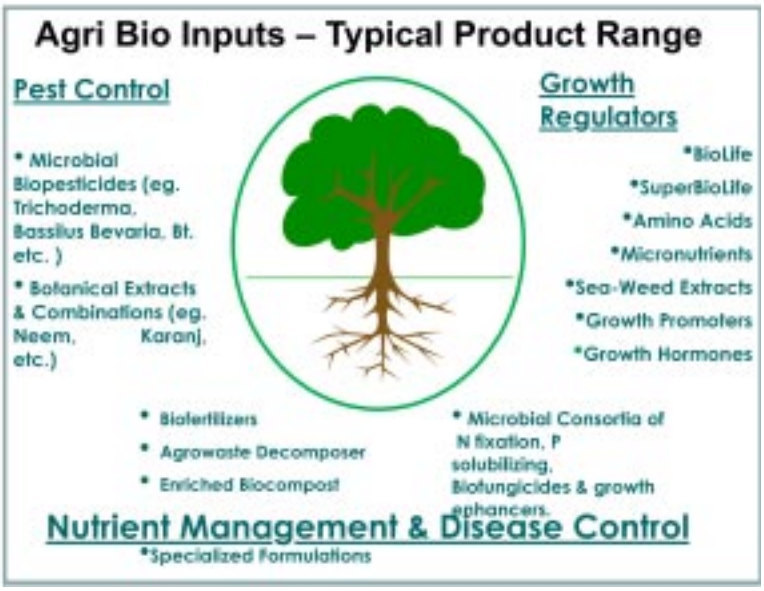
Annexure-1 : The typical range of products is given.

It is possible to enhance the farm productivity and at the same time lower the input costs through the use of agri biotech products. The range of multi-microbial consortia products play the key role in these combinations.

Field Demonstration & Triangular Arrangement :

A triangular arrangement involving an Agricultural University, a private biotech company and an NGO was thought to be the best way for taking up demonstrations of the new generation agri biotech products for practical field applications. A programme was taken up where Navsari Agricultural University (South Gujarat), (which is a leading Agri University with an experimental farm and specialized group of scientists), along with Gujarat Life Sciences (Pvt.) Ltd. (GLS)- a new generation agri and enviro biotech company and the NGO- The Science Ashram with a network of farmers and links with industries and universities was made for such a programme.

ANNEXURE - 1



Annexure - 2

Various products were taken up for field demonstrations, applications are listed (Annexure-2). The typical products involve – enriched biocompost, biopesticides, biofertilizers, etc. The list is typical and can be taken up as combination from different sources of suppliers also.

Annexure - 3 : Typical Field Demonstration Data :

In Table-2, a typical productivity enhancement data for different crops and different data are listed. Incidentally there may be variation for different crops and different locations, but clearly it is established that there is :

(a) Enhancement in productivity; and (b) Reduction in input costs of agrochemicals. Similarly in Table-3, typical data on disease control for various crops in different locations by use of biopesticides and biofungicides show excellent results. It is thus clear that a comprehensive model can be made available to the farmers, where substantial reduction in input costs and at the same time improvement in the productivity can be achieved. That this can be done through eco-friendly inputs is another big advantage for sustainable agricultural practices.

It may be noted that in explaining this model, the data for some typical bio products are given as indicative. Right combinations from any standard suppliers can be used. Farmers can also develop their own Biocomposts from their farm wastes, FYM etc. by using standard microbial cultures.

ANNEXURE - 3

Typical Data : Disease Control - Use of Biopesticides, Biofungicides.
Improvement : [Tricholife(Bio fungicide), Superlife, Wonderlife-G, Neem-A-Life, Mite-no-Mite(Bio pesticide)]

Crop	Location	Result
Brinjal	Saurashtra / Trichy – Tamil Nadu	Use of MiteNoMite has given control over mites and upto 15 days there was no need to do any other spray for mites.
Cotton	Central Gujarat Alwar - Rajasthan	80-85% control in various pests using Neem-A-Life
Groundnut	Saurashtra	90% control in fungal diseases with Tricholife + Superlife.
Roses	Mauritius – Central Trichy – Tamil Nadu	Use of Mite-No-Mite 90% control on Mite problem. Excellent Growth.
Potato	Central Gujarat	By using Wonderlife-G in Soil, disease control upto 94% and upto 22% increase in yield is achieved

ANNEXURE - 2

TypicalProductivity Enhancement Data – Multi microbial Products, Bio-Fertilizers and Biocomposts.
(Application of Bio Products – SUPERLIFE, WONDERLIFE, BIO COMPOST)

Crop	Location	Result
Banana	· Navsari - Navsari Agricultural University · Trichy – Tamil Nadu	Above 25% more production with above 20% reduction in urea dose.
Rice	· Bangkok – Thailand · Vapi - Gujarat	Increase in production from 14 to 19%.
Maize	Gauteng – South Africa	25% more production, 25% less UREA
Castor	Kutch - Gujarat	Increase in Yield 17-22%
Papaya	North Gujarat	Upto 21% increase in yield achieved

Conclusions :

(i) There is a dire need of improving farm productivity and equally the need to reduce the input costs.

(ii) The 20-20 Model can be taken up to substantially help the farmers in meeting such a goal.

Applicability of such a model is even more urgent under the present condition of water shortage and food crisis.

President - The Science Ashram - Vadodara, Hon. Chairman - Gujarat Life Sciences
[Ex-Vice Chancellor – Gujarat Agricultural University]

Ensuring the Unsure

M Parshad

Agriculture is among the oldest organised occupation and is termed the primary sector of the economy. Due to the late infusion of industrialisation and technology in agriculture, the impact of risk in agriculture seldom received the necessary attention it required. Now that the focus of developmental initiatives are more people centric and in less developed countries the majority of the population live in the agricultural economy, more attention is paid to risks in agriculture and this needs to be scaled up continuously to bring the much needed prosperity in the rural belt and at the same time to ensure the food security of the country.

Agriculture Insurance as a risk mitigation tool for the farmers is increasingly gaining recognition as a gateway to economic development and prosperity by managing effectively their unforeseen risks. This has become a mandate pursued by governments, regulators, and other agencies in the interest of the welfare of the consumer.

Agriculture Insurance Company of India Ltd was established with the intent to offer risk management through insurance to all farmers through products developed both under Government mechanism or independently using actuarial community.

COMPANY'S PROFILE

AGRICULTURE INSURANCE COMPANY OF INDIA LIMITED [AIC] was incorporated on 20th December, 2002 to exclusively cater to the insurance needs of the farming community, with Authorised Share Capital of Rs. 1500 crore and Paid-up Share Capital of Rs. 200 crore, contributed by the following:

- General Insurance Corporation of India [GIC] - 35%
- National Bank for Agriculture and Rural Development [NABARD] - 30%
- National Insurance Company Ltd. [NIC] - 8.75%
- The New India Assurance Company Ltd. [NIA] - 8.75%
- Oriental Insurance Company Ltd. [OIC] - 8.75%
- United India Insurance Company Ltd. - [UII] - 8.75%

AIC commenced its business on 1st April 2003 and, at present, the Company has a country-wide network of 17 Regional Offices at State Capitals, with its Registered and Head Office at New Delhi.

COMPANY'S VISION

- Accelerate the economic momentum of the Nation by bringing financial stability to rural India.
- Innovate and develop rural-oriented and farmer-friendly insurance products for all agricultural allied risks.
- Cast a protective net over agricultural and allied activities from natural perils and risks

COMPANY'S MISSION

- Agricultural insurance products be designed and developed on scientific basis and sound insurance principles to address diverse needs of farmers;
- Improve delivery and service of agricultural insurance so as to bring the remotest and poorest farmer under its umbrella in an economical and effective manner;
- Create widespread awareness about agricultural insurance as the principal risk mitigation tool, and thus establish it as an effective bulwark of the rural economy.

COMPANY'S ACTIVITIES

- Agriculture and allied insurance products, insuring more than 35 crops during Kharif and 30 crops during Rabi season.
- Implementing Agency for "National Agricultural Insurance Scheme" and "Weather Based Crop Insurance Scheme", the Crop Insurance Schemes of the Government.
- Create innovative, tailor-made & farmer-friendly insurance products for specific risk perceptions, the list which is constantly being updated is as under:

1. Varsha Bima
2. Rainfall Insurance
3. Potato Insurance
4. Mango Insurance
5. Wheat Insurance(NDVI+ Weather)
6. Pulpwood Insurance
7. Generic Weather Insurance(Rabi)
8. Coffee Insurance
9. Bio-fuel tree/plant insurance

COMPANY'S FINANCIAL PERFORMANCE
National Agricultural Insurance Scheme(NAIS)

Year	No. of Farmers Insured	Sum Insured (Rs. In Lakh)	Gross Premium (Rs. In Lakh)	Claims (Rs. In Lakh)	No. of Beneficiary Farmers
2003-04	1,23,92,117	11,16,362	34,739	1,14,974	38,10,394
2004-05	1,62,18,149	16,94,482	53,479	1,19,875	34,47,522
2005-06	1,67,22,357	18,59,076	55,477	1,39,825	36,46,732
2006-07	1,79,12,030	21,30,146	61,017	2,29,001	45,20,954
2007-08	1,84,42,577	24,47,419	68,302	1,71,120	31,49,085
2008-09* (provisional)	1,91,34,859	26,63,012	80,203	3,19,796	47,66,747

10. Coconut Insurance
11. Rubber plantation Insurance
12. Apple Insurance

COMPANY'S FINANCIAL PERFORMANCE

Based on the feedback relating to the existing crop insurance scheme, and with a view to provide the farmers with another option to insure their crops, the Hon'ble Finance Minister , announced during the budget for the financial year 2007-08 that AIC would be instrumental in introducing a Pilot Weather Based Crop Insurance Scheme (WBCIS).

The main feature of this scheme is that it is a parametric insurance product designed to provide insurance protection against losses in crop yield resulting from adverse weather incidences. It provides payout against adverse rainfall incidence (both deficit & excess) during Kharif and adverse incidence in weather parameters like frost, heat, relative humidity, un-seasonal rainfall etc. during Rabi.

AIC has so far insured 1004950 farmers under WBCIS and paid claims amounting to Rs 146.86 Crores which have benefitted 439408 farmers.

GLOBAL LEVEL PERFORMANCE AND RECOGNITION

Agriculture Insurance Company of India Ltd., is the first Indian company to win Innovation of the Year award, at the 12th Asia Insurance Industry Awards Ceremony held in Hong Kong. Shri M. Parshad, Chairman-cum-Managing Director of Agriculture Insurance Company of India Limited received this prestigious Award on 23rd November 2008, in the august presence of Industry Leaders, 600 of whom had gathered in the award function. The winner was selected by a distinguished panel of 20 judges including Regulators, Industry Leaders and Insurance Association's Heads through two rounds of evaluation and assessment.

The Chairman-cum-Managing Director put on record, during his acceptance speech, his appreciation and gratitude to the Government of India, the State Governments as well as all other Government institutions, including Commodity Boards, all financial institutions who support agricultural lending and extension work and all other service providers, who have helped AIC to make the weather based scheme a great success. He placed on record the committed service rendered by the employees of the company, which has a tradition of generating innovative products in its short history of the company since the commencement of its business in 2002.

INCREASING INSURANCE LITERACY AND CREATING AWARENESS

AIC is using several market strategies for achieving market deepening like moving from non-actuarial to actuarial premium regime, from being only an implementing agency for the government scheme to designing and marketing own product range, broadening customer base from loanee to include non-loanees in addition to:

- AIC is presently using insurance intermediaries like corporate agents and insurance brokers for marketing weather insurance products, in addition to rural banking network
- AIC has also enlisted micro insurance agents like NGOs for marketing its products from 2007-08 onwards
- AIC has requested IRDA to permit use of corporate entities working at grass-root level in agriculture and rural areas to work as 'channel partners' under referral arrangement for marketing weather insurance products

As on date the major challenge before AIC is to overcome the issue

'lack of crop insurance awareness' amongst farmers and secondly increasing the variety of products. To overcome this AIC is focusing on improving market penetration-through further improving the distribution channels of Financial Institutions, Brokers and Micro-insurance agents.

INNOVATIVE STEPS TAKEN BY AIC

Utilization of Satellite Imagery & other technologies in Crop Insurance

A Memorandum of Understanding has been signed between AIC and Department of Science and Technology (DST) under facilitation from Planning Commission and Ministry of Agriculture (GoI) for a project to examine the feasibility of using the Remote Sensing & GIS technologies in crop insurance. Initially, the Project would cover Kharif 2009 and Rabi 2009-10 season.

Under the project, the DST using Remote Sensing & GIS technologies shall provide to the Insurance Company the following information covering both Kharif & Rabi seasons:

(a) Certified output with respect to crop health at sub-district level (up to village level) at regular intervals for the identified locations & crops;
(b) Certified output with respect to crop acreage and yield estimates at village / cluster of villages within a month from the normal harvesting period for the identified locations & crops;
(c) Certified output on the occurrence of non-parametric weather phenomenon like hailstorm, thunderstorm, etc., in terms of occurrence, extent & magnitude, within three working days (72 hours) from occurrence:
(d) Certified Surface temperature data, daily rainfall data and Soil Moisture for the selected locations; and
(e) Any other service mutually agreed between the two parties in writing.

The above data will also be utilized to facilitate decision making on modified NAIS. For year 2009-10, 22 districts (from four States UP, Rajashan, Karnataka and Bihar) have been selected under this project:

For 2009-10, the States and Crops chosen under (a) & (b) above are:

(i) Uttar Pradesh: Kharif season - Rice and Maize; Rabi season - Wheat, Mustard, Chickpea, and Potato [Districts - Basti, Gorakhpur, Maharajganj, Kushinagar, and Deoria].
(ii) Rajasthan: Kharif season - Guar (Cluster bean), Bajra (Pearl millet), and Maize; Rabi season - Wheat, Mustard, and Chickpea [Districts - for Kharif: Churu, Hanumangarh, and Jhunjhunu, and for Rabi: Alwar, Ganganagr, and Sikar].
(iii) Karnataka: Kharif season - Rice, Ragi, Groundnut, Cotton and Arhar (Pigeonpea) [Districts - Belgaum, Dharwad, Gadag, Koppal, Haveri, and Bagalkot].
(iv) Bihar: Kharif season - Rice, and Maize; Rabi season - Wheat, Mustard, and Chickpea [Districts - Samastipur, Begusarai, Darbhanga, Munger, and Khagaria].

THE WAY FORWARD FOR AIC AND CROP INSURANCE

The Research and Development wing of AIC is actively involved in continuous innovations in customizing of existing products to meet the requirements of varied segments of the different agro-climatic zones of the country, besides designing and developing tailor made innovative insurance products.

By the percentage of population, India is still an agricultural country and the agricultural economy must become fully resilient and sustainable to achieve all round progress. In this scenario, the containment of risks occupies an ever increasing role, as this only will turn our farmers into prosperous agricultural entrepreneurs. Therefore all farm initiatives need risk containment steps, the main component of which will be insurance.

AIC has been formed at the initiative of the Government to ensure that the risks in the crop sector are adequately addressed and every agriculturist is given an opportunity to choose a risk containment insurance product of his/her choice. It is our endeavour to reach this objective in the near future.

CMD, Agriculture Insurance Company Of India Limited

Emerging Areas

Prospects of Organic Farming in India

Dr A Subba Rao[1] and Dr P Ramesh[2]

Organic farming is one among the broad spectrum of production methods that are supportive of the environment. Organic production systems are based on specific standards precisely formulated for food production and aim at achieving agro ecosystems, which are socially and ecologically sustainable. It is based on minimizing the use of external inputs through use of on-farm resources efficiently compared to intensive agriculture involving the use of synthetic fertilizers and pesticides.

"Organic" in organic agriculture is a labeling term that denotes products that have been produced in accordance with certain standards during food production, handling, processing and marketing stages and certified by a duly constituted certification body or authority. The organic label is therefore a process claim rather than a product claim. To promote organic agriculture and to ensure fair practices in international trade of organic food, the Codex Alimentarius Commission, a joint body of FAO/WHO framed certain guidelines for the production, processing, labelling and marketing of organically produced foods with a view to facilitate trade and prevent misleading claims.

Codex Alimentarius Commission defines "organic agriculture as holistic food production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system" (FAO, 1999).

Dr A Subba Rao

Table 1: **Land area of major countries under organic agriculture**

S. No.	Name of the Country	Area under organic agriculture(ha)	% of total agricultural land	Number of organic farms
1.	Australia	12294290	2.8	1550
2.	China	2300000	0.4	1600
3.	Argentina	2220489	1.7	1486
4.	USA (2005)	1620351	0.5	8493
5.	Italy	1148162	9.0	45115
6.	Uruguay	930965	6.1	630
7.	Spain	926390	3.7	17214
8.	Brazil	880000	0.3	15000
9.	Germany	825539	4.8	17557
10.	UK	604571	3.8	4485
11.	Canada	604404	0.9	3571
12.	France	552824	2.0	11640
13.	*India*	*528171*	*0.3*	*44926*
	World total	**30418261**	**0.65**	**718744**

Source: SOEL-Survey, 2008

Status of organic farming in the world

Based on the global survey on organic farming carried out 2007/ 2008 by the Research Institute of Organic Agriculture **(FiBL),** the International Federation of Organic Agriculture Movements **(IFOAM)** and Foundation Ecology & Agriculture **(SOEL),** *Organic agriculture is developing rapidly and is now practiced in more than* ***130 countries*** *of the world. Its share of agricultural land and farms continues to grow in many countries. According to the latest survey on global organic farming,* ***30.4 million hectares*** *of agricultural land are managed*

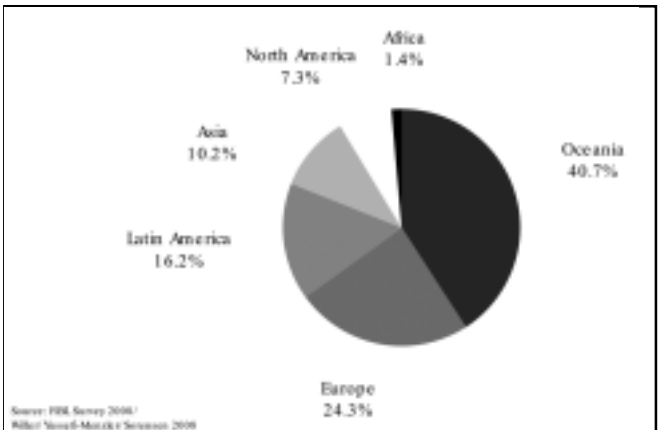


Figure 1: Distribution of the organic land by continent 2006 (Source: Willer 2008)

organically at the end of 2006. This constitutes a growth of 1.8 million hectares compared to 2005. Additionally, according to this survey, there are more than 30 million hectares of wild collection areas.

Oceania has the largest share of organic agricultural land, followed by Europe and Latin America. Currently, the country with the largest organic area is Australia (more than 12 million hectares). The proportion of organically compared to conventionally managed land, however, is the highest in Oceania and in Europe. In the European Union (EU 27) 4% of the land is under organic management. Most producers are in Latin America.

Global demand for organic products remains robust, with sales increasing by over five billion US Dollars a year. Organic Monitor estimates international sales to have reached 38.6 billion US Dollars in 2006, double that of 2000, when sales were at 18 billion US Dollars. Consumer demand for organic products is concentrated in North America and Europe; these two regions comprise 97% of global revenues. Asia, Latin America and Australasia are important producers and exporters of organic foods

Status of organic farming in India

In India about 3, 39,113 hectares area is under certified organic farming (this includes wild herb collection area of MP and UP) with about 1,41,904 numbers of farmers engaged in organic farming.

The Indian organic farming industry is estimated at US $ 78 million and is almost entirely export oriented. According to APEDA (2008), a nodal agency involved in promoting Indian organic agriculture, about 5,85,970 tonnes of organic products with a worth of 301 million rupees are being exported from India. Growing awareness, increasing market demand, increasing inclination of farmers to go organic and growing institutional support have resulted in to more than 200 % growth in certified area during the last two years.

Table 2: Present status of organic farming in India as per National Programme for Organic Production (NPOP)

Status as per 2006-07 records	
1. Total Production	585970 M.T.
2. Total quantity exported	19456 M. T.
3. Value of total export	Rs. 30124 lakhs
4. Total area under certified cultivation	3, 39,113 Ha. (This includes wild herb collection area of MP & UP
5. Number of farmers	1,41,904
6. Export value	78 Million USD
7. Percent of export	4
8. Percent domestic consumption	10
9. Potential share	5 -6 %
10. Anticipated by 2010	10 – 12 %

Source: APEDA, 2008

Significance of organic agriculture for Indian farmers

In the Indian context, organic farming can be significant in two distinct ways:

1. To increase the efficiency and sustainability of production: Organic farming can help to reduce production cost (especially where labour is cheap compared to input costs) and to increase or stabilize yields on marginal soils. This is especially relevant for small holders in marginal areas where Green Revolution agriculture has lead to a depletion of soil fertility and to high debts because of increase in input costs.

2. To increase product value: In areas where farmers have access to established organic markets within the country or abroad, products can achieve a higher price compared to the conventional markets. Especially in the trend of decreasing prices for agricultural products, this can be an important way to stabilize or even increase incomes.

There are several doubts in the minds of not only farmers but also scientists whether it is possible to supply the minimum required nutrients to crops through organic sources alone and even if it is pos-

sible how are we going to mobilize that much of organic matter. At this juncture, it is neither advisable nor feasible to recommend the switch over from fertilizer use to organic manure under all agro-ecosystems. Presently only 30 per cent of our total cultivable areas have irrigation facilities where agro-chemicals use is higher compared to rainfed zones. It is in the rainfed regions that ingenuity and efforts are required to increase crop productivity and farm production despite of recurrence of environmental constraints of drought and water scarcity.

The basic requirement in organic farming is to increase input use efficiency at each step of farm operation. This is achieved partly through reducing losses and partly through adoption of new technologies for enrichment of nutrient content in manures. Technologies to enrich the nutrient supply potential from manures including farm yard manure three to four times are being widely used at organic farms. According to a conservative estimate around 600 to 700 million tonnes of agricultural waste is available in the country every year, but most of it is not used properly or put to other uses. We must convert our filth/waste into wealth by mobilizing all the biomass in rural and urban areas into bioenergy to supply required nutrients to our starved soil and fuel to farmers. India produces about 1800 mt of animal dung per annum. Even if two-third of the dung is used for biogas generation, it is expected to yield biogas not less than 120 m m^3 per day. In addition the manure produced would be about 440 mt per year, which is equivalent to 2.90 mt N, 2.75 mt P_2O_5 and 1.89 mt K_2O.

Organic farm and food production systems are quite distinct from conventional farm in terms of nutrient management strategies. Organic systems adopt management options which primary aim to develop whole farm like a living organism with balanced growth in both crops and livestock holding. Thus nutrient cycle is closed as far as possible. Only the nutrients in the form of food are exported out of the farm. Crop residues burning is prohibited so is the unscientific storage of animal wastes and its application in fields. It is therefore, considered as more environmental friendly and sustainable than the conventional system. Farm conversion from high input chemical based system to organic system is designed after undertaking a constraint analysis for the farm with primary aim to take advantages of local conditions and their interactions with farm activities, climate, soil and environment so as to achieve as far as possible, the closed nutrient cycles with less dependence on off-farm inputs. As far as possible it implies that only nutrients leaving the farm unit are those that used for human consumption.

Crop rotations and varieties are selected to suit local conditions having potential to sufficiently balance the crops nitrogen demand. Requirements for other nutrients like phosphorus, sulphur and micronutrients are met with local, preferably renewable resources. Organic agriculture is therefore often termed as **knowledge based rather than input based agriculture**. Furthermore, organic farms aim to optimize the crop productivity under given set of farm conditions. This is in contrast to the concept of yield maximization through the intensive use of agrochemicals, irrigation water and other off farm inputs. There are ample evidences to show that agrochemical based high input agriculture is not sustainable for long period due to gradual decline in factor

Table 3: Major products produced in India by organic farming

Type	Products
Commodity	Tea, Coffee, Rice, wheat
Spices	Cardamom, black pepper, white pepper, ginger, turmeric, vanilla, mustard, tamarind, clove, cinnamon, nutmeg, mace, chilli
Pulses	Red gram, black gram
Fruits	Mango, banana, pineapple, passion fruit, sugarcane, orange, cashew nut, walnut
Vegetables	Okra, brinjal, garlic, onion, tomato, potato
Oil seeds	Sesame, castor, sunflower
Others	Cotton, herbal extracts

Source: Garibay and Jyoti (2003)

productivity with adverse impact on soil health, environment and quality of the produce.

Organic agriculture and yield

Yields relative to comparable conventional systems are directly related to the intensity of farming of the prevailing conventional systems. This is not only the case for comparison between regions, but also between crops within a region, and for individual crops over time. An over-simplification of the impact of conversion to organic agriculture on yield indicates that:

- In intensive farming system areas, organic agriculture may decrease yield; the range depends on the intensity of external input use before conversion.
- In the so-called green revolution areas (irrigated lands), conversion to organic agriculture usually leads to almost identical yields, provided sufficient organic source of nutrients are mobilized for use.
- In traditional rain-fed agriculture (with low external inputs), organic agriculture has shown the potential to increase yields.

A number of studies have shown that under drought conditions, crops in organic agriculture systems produce significantly higher yields than comparable conventional agricultural crops, often out-yielding conventional crops by 7–90%. Others have shown that organic systems provide stability to crop production. A survey of 208 projects in developing tropical countries, in which contemporary organic practices were introduced, showed average yield increases of 5–10% in irrigated crops and 50–100% in rainfed crops.

The so-called organic transition effect, in which a yield decline in the first 1–4 years of transition to organic agriculture, followed by a yield increase when soils have developed adequate biological activity, has not been borne out in some reviews of yield comparison studies. Trials conducted on organic cotton at Nagpur indicated that after the third year, the organic plot, which did not receive fertilizers and

insecticides, produced as much cotton as that cultivated with them. Similarly, studies conducted at Indian Institute of Soil Science, Bhopal, Madhya Pradesh and in Punjab clearly indicated that organic farming with adequate organic inputs gave higher or equal yields of different cropping systems compared to chemical farming after an initial period of three years.

Conclusions

Only 30% of India's total cultivable area is covered with fertilizers where irrigation facilities are available and in the remaining 70% of arable land, which is mainly rainfed, negligible amount of fertilizers is being used. Farmers in these areas often use organic manure as a source of nutrients that are readily available either in their own farm or in their locality. The northeastern region of India provides considerable opportunity for organic farming due to least utilization of chemical inputs. It is estimated that 18 million hectare of such land is available in the NE, which can be exploited for organic production. With the sizable acreage under naturally organic/default organic cultivation, India has tremendous potential to grow crops organically and emerge as a major supplier of organic products in the world's organic market. The report of the Task Force on Organic Farming appointed by the Government of India also observed that in vast areas of the country, where limited amount of chemicals is used and have low productivity, could be exploited as potential areas for organic agriculture. Arresting the decline of soil organic matter is the most potent weapon in fighting against unabated soil degradation and imperiled sustainability of agriculture in tropical regions of India, particularly those under the influence of arid and semi-arid climate, hills and mountain regions. Application of organic manure is the only option to improve the soil organic carbon for sustenance of soil quality and future agricultural productivity. It is estimated that around 700 mt of agricultural waste is available in the country every year, which can effectively be recycled, composted and used as manure. There are several alternatives for supply of soil nutrients from organic sources like enriched composts, vermicompost, biofertilizers, etc. Technologies have been developed to produce large quantities of nutrient-rich manures/composts. There are specific biofertilizers for cereals, millets, pulses and oilseeds that offer a great scope to further reduce the gap between nutrient demand and supply. There is no doubt that organic agriculture is in many ways a preferable pattern for developing agriculture, especially in dry lands, tribal areas and low input agricultural and horticultural systems for improved productivity and long term sustainability.

[1]Director, [2]Principal Scientist, Indian Institute of Soil Science, Bhopal

ICTs in Agriculture

The Road Ahead

Dr. V.P. Sharma

The Agriculture sector is gearing itself to make optimal use of the new information and communication technologies. At the Government of India levels, a number of important initiatives have been taken to provide ICT(Information and Communication Technologies) Hardware and connectivity to all organizations involved in Agricultural Education, research, development and dissemination. Simultaneously, Agricultural content development initiatives have been taken up by Ministry of Agriculture, in collaboration with State Departments of Agriculture and National Informatics Centre (NIC), to provide Agricultural information including crop production, protection, Government Schemes and marketing information of various agricultural commodities to the farming community. Another content-creation and aggregation initiative is being supported by Indian Council of Agricultural Research (ICAR), under its World Bank aided project – National Agricultural Innovations Project (NAIP), wherein the Leading ICT institutions like IIT Kanpur, IIT Mumbai, IITKM, Kozikode and International Crop Research Institute for Semi-Arid Tropics (ICRISAT) have been roped in to guide National Agricultural Research System to design, develop and implement Knowledge Management Systems (KMS) in Agriculture.

ICT or Information and Communications Technology in simple terms, are defined as the basket of technologies which assist or support in storage, processing of Data/ Information, or in dissemination/ communication of Data/ Information, or both. ICT thus includes technologies such as desktop and laptop computers, software, peripherals and connections to the Internet that are intended to fulfill information processing and communications functions. ICT is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning.

The importance of ICT lies, less in the technology itself, than in its ability to create greater access to information and communication among the hitherto un-reached geographies and populations. The "Grameen Phone" initiative in Bangladesh, Kothamale Radio Project in Sri Lanka, Kisan Call Centres (KCC) and ITC's e-Chaupals in India, are examples of such innovations.

ICTs are most natural allies to facilitate the outreach of Agricultural Extension system in the country. Despite a large, well-educated, well-trained and well-organized Agricultural extension manpower, around 60% of farmers in our country still remain un-reached, not served by any extension agency or functionary. Of the 40%, who have some access to Agricultural Information, the major sources of this information are Radio and Television. The telephone has just started to make its presence felt on this scenario. During last 5 years of its operations, the Kisan Call Centres (KCC) helpline- 1551, has registered over 3.4 million (34 Lakh) calls. Internet-supported Information-Kiosks known as Community Information Centres (CICs) in some state, Village Knowledge Centres (VKCs) and Common Service Centres (CSCs) in some other states are also serving the farming community, in many parts of the country. Hence ICTs are highly relevant for Agricultural Extension scientists, researchers, functionaries and organizations.

Agriculture and Indian Economy:

The Agriculture sector was, is and will remain an important sector of Indian economy, for foreseeable future. Although its contribution to Gross

Domestic Product has come down to less than 17%, Agriculture is still the primary source of livelihood for over 230 million farmers and agricultural labour. In total, Agriculture still supports over 600 million people and 52% of the work force even today. The agriculture sector in India has been successful in keeping pace with the rising food demand of a growing population, which has crossed the one billion mark. The food grain production more than quadrupled since early 1950s from 51 million tones to over 230 million tones in 2007-08, while the population nearly tripled from 350 million to one billion during the same period. The green revolution has been the corner-stone of India's agricultural achievement, transforming the country from one of food deficiency to self-sufficiency. The green revolution however remained restricted to the well-endowed, irrigated areas of the country. Of late, deceleration in production and factor productivity growth in some of the major irrigated production systems especially in the north and north-west regions have been recorded. Potentially high production areas (eastern and central states) are still lagging behind in productivity increases.

Public research and extension played a major role in bringing about green revolution. In the post green revolution era, however, extension faces important challenges in the areas of relevance, accountability and sustainability. It is becoming increasingly evident that public extension by itself can no longer respond to the multifarious demands of farming systems. The Policy Framework for Agricultural Extension (PFAE) of Government of India envisages a crucial role for agricultural extension. For this the extension agencies will have to play a more broad based role and the extension workers will need to exercise a more proactive and participatory role, serve as knowledge agents, initiating and facilitating mutually meaningful and equitable knowledge based transactions among agricultural researchers, trainers and primary producers.

Changing Information Needs of the Farmers:

Today's farmer requires more information on marketing prices in nearby markets, marketing intelligence and precision farming, rather than on package of practices for common crops. Farmers have increasingly begun to perceive packaging, processing, storing and marketing rather than production as the major constraint to enhancing farm incomes. With major thrust of extension agencies on production techniques only, post-harvest technologies, marketing extension so far has not received the required attention. The farmers today need information on Government schemes, subsidies, Credit facilities (including source, terms and conditions), crop Insurance products, Market prices (mandi wise), trends, stocks, post-harvest technology, availability of farm equipment (for purchase and hire), besides variety of seeds, pesticides and fertilizers. All this information is time and quality critical. It has also to match geographical (agro-ecological) requirements. And hence the information has to be authenticated by the concerned KVK/ State Agricultural University/ Department of Agriculture on regular basis. There is thus, a need for reappraisal of the capacity of existing agricultural extension systems to effectively address the contemporary and future needs of the farming community.

Agricultural Information Delivery Systems:

There is a huge gap in Agricultural Information dissemination system. The extension professionals of public extension system are hardly equipped to address this issue, and hence, there is a strong need for alternative channels of information from national and international markets, agri-produce companies (for seeds, fertilizers and pesticides) and also on processing and packaging practices to meet the requirements of agri-retail chains. The knowledge absorption capacity of the farmers needs to be upgraded, so that they can take more informed decisions. ICT is seen as an important means of achieving such a transformation. When used as a broad tool for providing local farming communities with scientific knowledge, ICT heralds the formation of knowledge societies in the rural areas of the developing world. However, this can only be realised when knowledge and Information are effectively harvested for overall agricultural development. The development of precision farming in countries of the North emphasizes knowledge-intensity; hence the new extension approach in the country will have to be recast to take advantage of knowledge availability to achieve multiple goals: of income, food, jobs, etc.

ICT and Agricultural Information Dissemination:

With appropriate use of ICT tools, the outreach of ICAR system and SAUs can increase manifold. It can bring the scientists in direct touch with the farmers on daily basis. The availability of mobile phones in rural hinterlands has brought revolution in farmer-scientist interactions in Maharashtra, with the farmers getting daily alerts through SMS (Short Messaging Service) on crop prices, weather alerts, etc. It can bring new information services to rural areas where farmers, as users, will have much greater control than before over current information channels. Access to such new information sources is a crucial requirement for the sustainable development of the farming systems. Broad basing Agricultural extension activities; developing farming system research and extension; having location-specific modules of research and extension; and promoting market extension, sustainable Agricultural development, participatory research, etc. are some of the numerous areas where ICTs can play an important role.

Extension Official as Knowledge Worker:

With the use of ICTs and tools like Internet and World Wide Web, the Extension Workers can be connected to the best of scientists in agricultural universities and research stations, spread across the country. ICTs can enable the extension workers to gather, store, retrieve and disseminate a broad range of information needed by farmers, thus transforming them from extension workers into knowledge workers. The emergence of such knowledge workers will result in the realization of the much talked about bottom-up, demand driven technology generation, assessment, refinement and transfer. The first step for the Extension Officials in this direction will be to grow from narrow mindset of "Transferring the Technology packages" to "Sharing the Knowledge and Information packages". The Agricultural Extension as a profession has to transform its outlook from definition of Agricultural Extension as a process of "Technology Transfer" to a process of "facilitating Information Sharing and Building Agricultural Knowledge Networks". The Agriculture, as a sector has to shift from production-focused/ input-driven growth paradigm to a knowledge based / demand-driven sustainable enterprise.

Applications of ICT in Agricultural Extension: Current Status:

There are a number of Agricultural Information Delivery Pilot Projects in the country, where some state Departments of Agriculture, District Administration or SAU and in some cases NGOs have taken the lead to demonstrate the efficacy of providing "on-line" Agricultural Information to the farmers. These include: Information Villages in Pondicherry (project by MSSRF, Chennai, since 2000), Gyandoot- a project of District Administration Dhar, M.P., Warna Wired Villages in Kolhapur and Sangli District of Maharastra by NIC, Delhi, Warna Cooperative Society and Govt. of Maharastra, etc. Some of the successful and effective projects include:

- On-Line services for information on each crop (crop-management-right form seed availability, soil preparation to harvesting, post-harvesting and packaging), from known and nearest authentic sources like–the concerned SAUs(Example – The Agrisnet Portal of Department of Agriculture, Government of Andhra Pradesh www.apagrisnet.gov.in)
- On-Line interaction facility to interact with nearest KVK, SAU, ICAR Research Station and the Departments of Agriculture, Horticulture, Fisheries, Animal Husbandry etc. for advice on current schemes, projects, varieties(KVK Babhaleswar, District Ahmednagar, Maharastra);
- Question-Answer service for each District in the country (Example aAQUA Almost All Questions Answered portal developed by IIT Mumbai and being used by KVK Baramati, UAS Dharwad and its KVKs, G.B.P.U.A.T. Pantnagar and its KVKs http://aaqua.persistent.co.in) ;
- On-line monitoring and Information Sharing on All Agricultural Development Projects in the country (including their financial allocations and progress on each head, district wise)(Example : Agri-Clinic and Agri-Business Centre, ACABC Website of MANAGE www.agriclinics.net);
- On-line sharing of District Agriculture Development Plans (e.g. Strategic Research and Extension Plans, SREPs prepared under National Agricultural Tech-

nology Project (NATP) in 28 district during 1998-2004);

- On-Line Information on Market prices of all commodities at mandal, Block (taluka), District, State and major national market level (Example www.agmarknet.nic.in);
- On-Line Weather forecasting and its impact on major crops (state wise, district wise) on weekly basis, including early warning systems (Example www.agmarknet.nic.in);

The Road Ahead:

The National Seminar on Agricultural Extension organized during February 27-28, 2009 (NSAE, 2009) has brought out a number very important recommendation to deploy ICTs to enhance the efficacy of Extension System. These recommendations include:

- Develop national database on pests and diseases
- Facilitate greater access of technologies to the resource poor farmers;
- Develop artificial intelligence based expert systems
- Develop Knowledge creating networks and trigger innovations for sustainable agriculture;
- ICT should be promoted for knowledge and information about technology; innovative farm technologies; capacity building of farmers to adapt technology, input/credit; post harvest technologies and marketing services;

- Government agencies should play a bigger role in both networking and content development at the district, state and national level;
- Connectivity, Content and Sustainability should receive concurrent attention;
- The information provided through ICT should be demand driven and should be relevant to the needs of farming community;
- Community Radio station for agriculture and rural development should be promoted in Public – Private Partnership model;
- Community radio, Call centers and Mass media need to be harnessed for wider dissemination of best practices;
- Village Knowledge Centers and online databases in local languages should be established. Liberal access should be ensured to the vast pool of farm knowledge to all players in public and private domain;
- Map knowledge of farmers through Village Knowledge Management Systems;
- Knowledge management, market intelligence and post harvest management need to be integrated with the extension system;
- Farm journalism should be promoted by suitable arrangement for documenting success stories and best practices;
- To exploit ICT, extension workers require more training

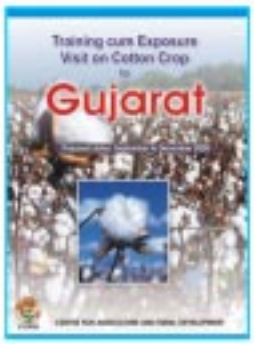
Conclusion:

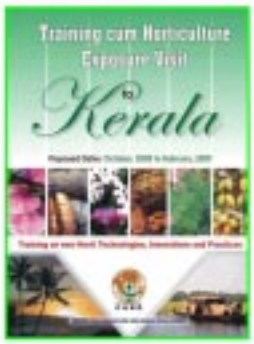
ICT usage in Agriculture has got good start in last ten years. A number of Pilot projects have succeeded to reach a stage of Roll-out. ICT connectivity has reached all districts and Blocks in the country. Telephone density has also crossed 35% mark. Common Service Centres (CSCs) are also being rolled-out country-wide under PPP mode. Over 5000 Agric-clinic Agri-business centres have been established by trained agri-graduates. Thus, the delivery mechanism for "Agricultural Information" content is almost ready. The only missing link is the "Content". We need to take up this task on urgent basis.

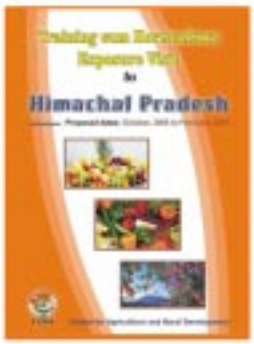
Director-IT, Documentation and Publications, MANAGE, Hyderabad

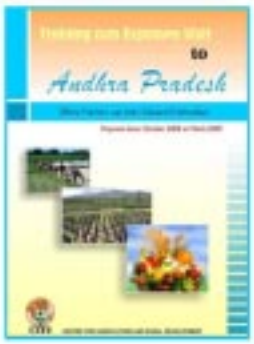
CARD

Farmers Study Tour Programs

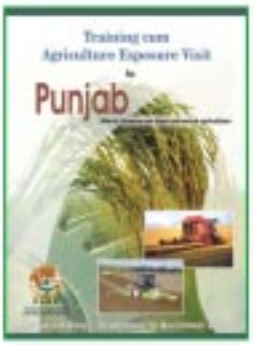


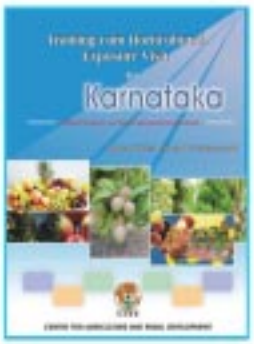


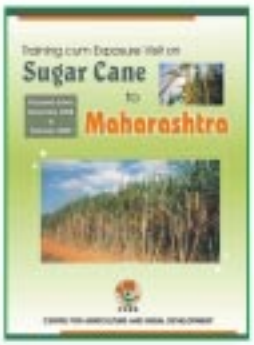




Exploring places & Training on new Agri/Horti Technologies, Innovations and Practices







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ORGANIC RICE IN INDIA

State of the art and future scenario

[1]DrTK Adhya and [2] Dr A Ghosh

Indian agriculture, as of today, advances from traditional wisdom to the future conviction of food, nutritional and environmental security. The golden era of green revolution has witnessed India's agricultural achievement transforming the country from the stage of food deficiency to self-sufficiency. Achieving that goal required intensive agricultural management, which has resulted in an indiscriminate and excessive use of chemicals. The alarming proximity of pesticides and agrochemicals to the intensive rice farming emerges as a great concern posing serious threats to the agriculture today. Concomitant with the achievement of food security, the post green revolution era impacted adversely the health and environmental security, in contrast. This realization may pave the way of reviving the age old culture of organic agriculture. Since recent past, the prospect of organic rice farming has got momentum in cognizance with its considerable demand globally.

Organic agriculture

The global market for organic food is worth $37 billion and is growing fast. The United States emerged as the largest importer of organic foods, followed by the European Union. Now, the "organic culture" is spreading globally. Though organic agriculture accounts for a negligible portion of the country's total farm produce, there is a great demand for it in the international market. Unfortunately, despite having its potential, India is yet to derive much benefit from exporting organic foods. India's export of organic food is worth hardly Rs.90 crores.

Organic rice

Rice farming in our country is traditionally 'by default' organic in nature and farmers were used to apply organics in rice cultivation in either of the forms & ways, till the middle of the last century. Ironically, majority of the rice farmers are poor and marginal and dilemmas dominate the life of this poor rice farmers. Most often, inconsistent government policies create these dilemmas that sometimes prove disastrous. Of late, these farmers are being persuaded to switch over to the age-old organic rice farming and thus gradually phase out the consumption of chemical fertilizers. In fact, it is again a policy-driven dilemma. Organic food is undoubtedly the best choice for human health and nutritional security. In contrasts, it is not at all an easy task for the performance-oriented farm sector venturing the age old practice for its revival, until it becomes sensitive to the ecological crises ahead.

Area & Production

Estimation of area and production of organically grown crops is very difficult task as there is no such central agency for collection of the information and their systematic documentation. However, National Program for Organic Production (NPOP), APEDA has reported an area of 25,08,826 ha under organic agriculture with a production of 14,000 tons, of which organic rice contributes around some 24%.

DrTK Adhya

Export potential

Our country exports 31 organic products. It is estimated that around 85% of the total organic production in our country is exported. Although, global market for organic food is expanding very fast, the demand for organic rice does not commensurate with the demands for other high value crops. In this context, the views of NAAS are worth-mentioned. In one of its policy paper, NASS has mentioned " To begin with, the practice of organic farming should be for low volume, high value crops like spices, medicinal plants, fruits and vegetables.(Organic Farming: Approaches and Possibilities in the context of Indian Agriculture, Policy Paper 30,NAAS, February 2005). Obviously, so far as Indian agricultural scenario is concerned, organic rice cultivation is yet to be considered one of the thrust areas of its research agenda. The possible reason as rightly stated by the Agro Division of Export- Import Bank (EXIM Bank Agro) is "In India, the demand for organic rice is limited

possibly on account of lack of awareness and lack of market distribution channel".

Myths and facts in organic rice culture

Multifarious advantages are there while growing rice organically. Still, some misconception exists, which needs to be clarified.

1. Recent research does not witness any proven environmental benefits in organic rice system when the environmental impact is expressed on a per ton rice-produced basis.
2. Just one or two years of applying organic materials do not necessarily bring significant increase in soil organic matter content.
3. Organic fertilizer is not the sole factor in improving the quality of the food product, such as increased antioxidant content.
4. Unlike chemical pesticides, use of biocides or botanicals requires larger quantity of raw materials for adequate availability of active ingredient, which is often found unfeasible. On the other hand, marketable products more often prove to be spurious and not conforming to the organic norms.

Problems ahead

There are some inherent problems hindering desirable expansion of organic rice cultivation in our country. In one hand it includes researches in right perspective on the other hand, formulation as well proper execution of discrete government policy is missing.

POLICY

1. Local market demanding organic rice is not lucrative hence production scenario could be connected to its export potentials. Appropriate strategy for marketing of organic rice linking authenticated growers to the global market would encourage farmers to grow organic rice.
2. Certification of organic rice for export requires strict vigilance else export may suffer a set back as happened in the recent past when Finland rejected organic rice consignment from our country due to contamination of methyl bromide.
3. A short-term yield reduction, common in organic rice production system, not only requires premium prices but government subsidies too, to maintain organic cultivation economically viable on a large scale.
4. Not only certifying the end product, i.e, grain, the organic inputs as well as entire production system needs to be supervised and certified. Because, organic rice cultivation is also a 'process certification' than 'products certification' alone.

RESEARCH

1. HYV rice developed so far are mostly responsive to high inputs and intensive management. Contrary to that, organic rice cultivation is an environmentally sustainable management practice. Thus, it requires development of HYV which would respond well to organic management with resistance/ tolerance to major pests and diseases.
2. Under condition of minimum oxygen level (as in flooded rice soils), applying organic fertilizers may produce organic acids and other toxins harmful to the plant. Thus, it requires proper decomposition, prior to their field application.
3. Quality of 'enriched' organic fertilizers available commercially should be ensured to avoid contamination from inorganic agrochemicals.
4. Usually, production would be less during the initial years before soil fertility status is built up sustaining adequate nutrients supply. The investment during this lag phase in the course of producing organic rice needs to be compensated.
5. There is no fixed or stable proportion of plant mineral nutrients in the sources of organic fertilizers applied in rice. Therefore, prolonged organic practices can result in nutrient imbalances in rice soil, in both the extremes of deficiency or toxicity.

Conclusion

It is often said that organic rice cultivation *per se*, would perpetuate food insecurity and poverty in Asia because they are typically lacking essential nutrients and confer few, if any, benefits in terms of sustainability. In cognizance with the growing demand for organic rice in the global market, scientist, policy makers and stakeholders alike need to work hand in hand to resolve the problems of cultivation. It is admitted that mere growing organic rice alone may not appear to be a profitable enterprise and even sometimes non-remunerative. Scientists have to develop location specific organic rice-based farming systems. This would enable the farmers to recycle residues of both crop and animal enterprises and thus can resolve the problems of generating larger quantity of organic nutrient sources within the farm itself. Nonetheless, this unique venture could help farmers harvest other farm commodities along with rice grown under organic environment in one hand and could fetch greater benefit in totality.

[1]Director, [2]Pr. Scientist, Central Rice Research Institute, Cuttack

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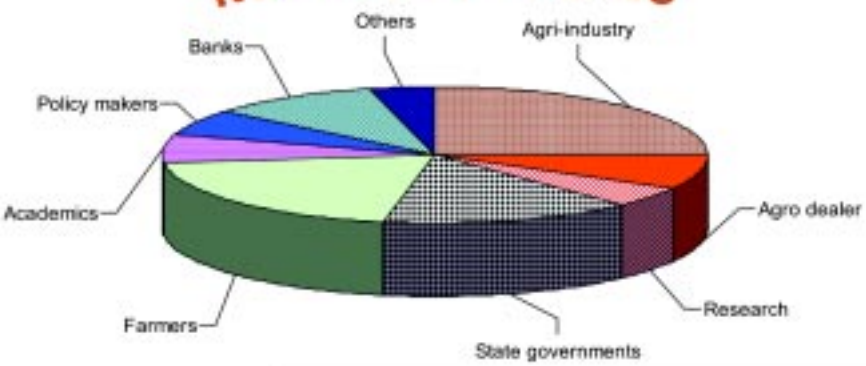

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Organic Agriculture and Markets in India: An update

Manoj Kumar Menon

Introduction

In the late 1960s, due to increasing population and faced with food scarcity and security, India ushered in the green revolution. In the following two decades, India witnessed a boost in agricultural pro-ductivity thanks to the developments in Indian agriculture, includ-ing its scientific and policy direction, and led by eminent research-ers and agriculture scientists.

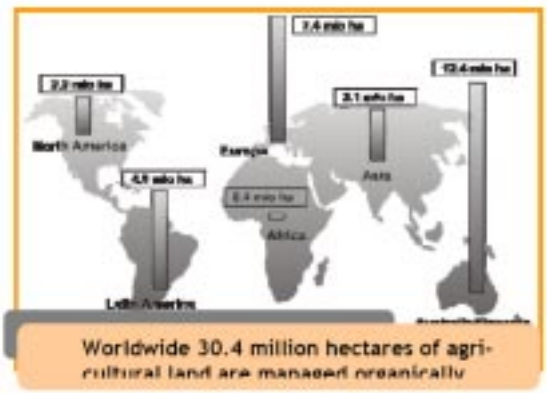
The Green revolution technologies involved high usage of synthetic agrochemicals such as fertilizers and pesticides and adoption of nutrient- responsive, high-yielding varieties of crops. These meas-ures boosted the production output per hectare in most of the cases but it is apparent two decades later that this increase in production has slowed down and in some cases there are indications of decline in growth of productivity and production (Source-Planning Com-mission- 'Approach Paper to the 11th Five year Plan). Also, the excessive use of pesticides and fertilizers have resulted in far-reaching ecological and environmental damages viz. drastic decline in soil fertility, lowering water tables and increasing toxicity in food products. These results have made a compelling case for scientists and policy makers to restructure Indian agriculture and production of safe foods.

Increasing consciousness about conservation of environment, health hazards associated with agrochemicals and consumers' preference to safe and eco-friendly food are the major factors that lead to the growing interest in alternate forms of food production in the world. Consumers are asking for eco-friendly products across the world and India is also catching up fast in this trend. Eco-friendliness has various parameters and it has started to go beyond only soil, water, air; as it started to address the interrelation of society to its entire surroundings including ecology, man, animal, their health and how they are cared.

These attributes are enshrined as four cardinal 'Principles of Or-ganic Agriculture' by the International Federation of Organic Agri-culture Movement, Germany (IFOAM), an umbrella organization working closely with the international community including FAO, Codex Elimentarius, EU, USDA, etc. It states that Organic agricul-ture is based on the following "Principles of Organic Agriculture" (www.ifoam.org)

Development of organic agriculture Worldwide:

Recently, United Nations Food and Agricultural Organisation (FAO) in its report *Organic Agriculture and Food Security* explic-itly states that organic agriculture can address local and global food security challenges. The organic sector is flourishing today more than ever.



The world community is increasingly becoming aware of the need to preserve Mother Nature. All over the world, synthetic/chemical products are quickly replaced by eco-friendly organic products. Organic agriculture is developing rapidly and is now practiced in more than 130 countries of the world. Its share of agricultural land and farms continues to grow in many countries. Worldwide 30.4 million hectares of land is cur-rently under organic production. The value of world trade today is US $ 40 billion, while it was only US $ 18 billion in 2000. And the world trade of organic products is expected to reach USD 100 billion by 2012, as estimated by Organic Monitor, UK.

Development of organic agriculture in India

Organic farming is not new to Indian farming community. Several forms of organic farming are being successfully practiced in diverse climates. Among all farming systems, organic farming is gaining wide attention among farmers, entrepreneurs, policy makers and agricultural scientists for a number of reasons: Organic farming minimizes the dependence on chemical inputs (fertilizers; pesti-cides; herbicides and other agro-chemicals) and thus safeguards/improves the quality of the natural resources and the environment.

Organic systems have been thriving in various parts of India for 20 to 25 years now, but no systemic and institutional work had hap-pened until 2001. In 2001, the Government of India started the 'Na-tional Program on Organic Production' (NPOP). From 2005, the International Competence Centre for Organic Agriculture (ICCOA: www.iccoa.org) based in Bangalore started organizing India's big-gest marketing platform, 'India Organic Trade fairs' for organic and related eco-friendly products. Since then, India's organic sector has shown rapid progress.

In 2003 only 73'000 hectares of cultivated land was certified or-ganic, and by 2007 it touched 538'000 hectares. By 2008, this fig-ure was 401'000 hectares with another 464'000 hectares under con-version – thus a total of 8,65,000 ha is organically managed in In-dia. This constitutes, however, only 0.61 % of the total cultivated area of 142 million hectares.

1. Principle of Health	3. Principle of Fairness
2. Principle of Ecology	4. Principle of Care

History of organic farming in India: Milestone list

January 1994: The 'Sevagram Declaration' for the promotion of organic agriculture is followed by large number of organic practitioners through-out India.

2001: The Government of India launches the National Programme on Organic Production (NPOP).

2001: India develops its own National Standards for Organic Production (NSOP), similar to the IFOAM and other world standards.

2001/2002: Establishment of a National Accreditation Body with the Agricultural & Processed Food Products Export Development Authority APEDA as the nodal agency.

2001/2002: Organic certified area recorded at 42'000 hectares

2003/2004: Organic certified cultivated area at 76236 ha (Total area include forest areas with wild herbs were 2508826 ha.

2005: First 'India Organic Trade Fair' organized by the International Competence Centre for Organic Agriculture ICCOA in Bangalore. Since then it has become an annual event.

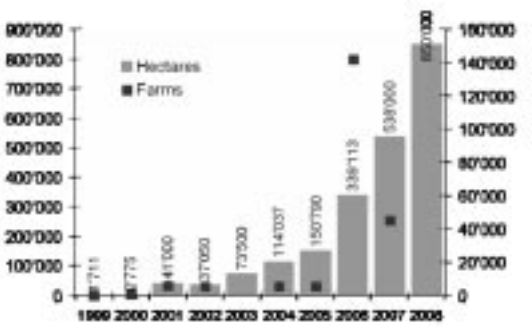
2005: The organic certified area rises to 76'000 hectares.

2006: India's NSOP acquires the status of equivalence with the EU and Swiss Standards. India's accreditation system attains equivalence with the US National Organic Programme.

2007: The organic certified area rises to 538'171 hectares.

2008: The organic certified area rises to 865000 hectares. 12 organic certification agencies are accredited.\

2008: The fourth edition of India Organic Trade Fairs are organized in New Delhi by ICCOA in partnership with the National Centre for Organic Farming (NCOF) and APEDA.



Graph 1: Development of the organic and in-conversion land area in India

Source: FiBL/SOEL Surveys, APEDA. Graph: FiBL

Markets:

India was exporting organic products to the value of only 730 million Indian Rupees in 2003 and in 2008-09 this figure touched 4500 million Indian Rupees constituting almost 0.25 % of the organic world market. In parallel, the domestic market for organic products in India is also growing, and India's first market survey conducted by the International Competence Centre for Organic Agriculture ICCOA (Rao Kishore et al.) indicates a huge potential of over Rs. 1500 crores (Rs. 15 bn) in the eight major cities alone. In the com-ing years. India should target to reach at least Rs. 4000 crores (Rs. 40 bn) 2012 (domestic market and exports), thereby capturing ap-proximately 2.5% of the current global market for organic products.

Domestic markets in India (Nationwide survey):

ICCOA conducted a market study in 2006 in the top 8 metros, cov-ering SEC A and SEC B segments of the consumers, which com-prise about 5.3 % of the households. Over 3600 consumers among the target group were surveyed across four regions of the country.

The market study estimates the accessible market potential for or-ganic foods in the top 8 metros of the country at Rs 562 crores, tak-ing into account current purchase patterns of consumer in modern retail format. It is hypothesized that for some time to come Organic foods will cater to the up market customer through these formats or dedicated organic retail stores. The overall market potential is esti-mated to be around Rs.1452 crores, the availability will however be a function of distribution-retail penetration and making the product available to the customer.

	2003	2007	2012
Organic area	76000 hectares of cultivated area; ca. 2.4 million hec-tares wild collection area	538'000 hec-tares =0.35 % of the agricultural land	2 million hec-tares =1.5 % of the agricul-tural land
Exports from India	730 million Indian Rupees	3.5 billion Indian Rupees	25 billion In-dian Rupees
Share of global market		0.2 %	2.5 %
Domestic market		Rs. 100 crores	Rs.1500 crores
Total turn-over with or-ganic prod-ucts (domestic and exports)		Rs. 450 crores	Rs. 4000 crores

Biofach India together with India Organic

ICCOA has organized four editions of India Organic trade fairs annually since 2005. This fair has become one of the biggest events in this part of the world.

In 2009 the organizers of the Biofach World Organic Trade fair, Nurnberg Messe, Germany entered into an MoU with ICCOA for jointly organizing the International Organic trade fairs in India. The first Biofach India together with India Organic fair is being organ-ized in Mumbai from 18-20 November 2009. Thus India becomes an important destination of the organic sector worldwide.

Future projections

The area under organic cultivation is likely to cross the two million hectare mark by 2012, according to National Centre for Organic Farming NCOF under the Union Ministry of Agriculture and Inter-national Competence Centre for Organic Agriculture ICCOA. This constitutes more than two-fold growth from the present 865'000 hectares.

The market for organic produce from and within India is expected to grow six to seven times in the next five years. India may reach 40 billion Indian Rupees (Rs. 4000 crores) by 2012, thereby reaching about 2.5 % of the current global trade value –

- Exports form India reaches about Rs. 2500 crores.
- Domestic markets within India reach about Rs. 1500 crores.

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A thought...

SECOND GREEN REVOLUTION AND SUSTAINABLE DEVELOPMENT

Dr KP Agarwal

The country is passing through acute agrarian crisis. There has been marked slowdown in growth rates in the traditional green revolution states and bread basket of the country, namely Punjab, Haryana and Uttar Pradesh. The lower growth rates in these states which account for about 75% and 25% of production of wheat and rice respectively have endangered food security in the country. Total Factor Productivity (TFP) grew by 2 percent/ year between 1981 and 1990, it became negative during 1990-96 in the Indo-gangetic plains, which is spread over the states of Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal.

Low public investment, soil deterioration, shifts towards cash crops, mono-cropping, post-harvest wastes, low value addition, neglecting rainfed agriculture, lack of institutional credit/ crop insurance, low price of farm produce and high input cost, lack of alternative non-agricultural income opportunities and poor extension delivery are ailing Indian agriculture. Other factors contributing to low performance of the agriculture sector are lack of market information, poor market infrastructure, small and scattered land holdings. Further, poor land use practices have resulted in high levels of soil erosion, destruction of farm land, loss of vegetation, reduction in soil fertility of agriculture land and other pressures on natural resources. There are yield gaps between different regions of the country and also between actual yields and the yield potentials that are technologically feasible. The yield gap varies from 40 percent and 100 percent respectively. Production can be increased if this yield gap is bridged.

Most of the farmers in India are small and landless and depend upon agriculture for their livelihood. Within the limited scope for area expansion, enhanced productivity, profitability and competitiveness would be the main focus of sustainable agricultural growth in future. In other words, it calls for the Indian agriculture to shift from resource or input based interventions to knowledge or science based growth.

First Green Revolution Technologies Fatigued:

Green revolution technologies (high yielding varieties, chemical fertilizers, synthetic pesticides, irrigation, mechanization, mono-cropping etc.) led to rapid agricultural growth, eliminated famines and achieved food self sufficiency in 1990s. The growth in agriculture helped reduce poverty from 53% in 1977-78 to about 26% in 1990-00. Green revolution

technologies fatigued with passage of time. The gains could not be sustained. Slow down in agricultural growth is greatest in green revolution states. There is increasing natural resources degradation, namely the problem of water logging, salinity and over extraction of ground water particularly in high potential irrigated areas. Unbalanced fertilizer and pesticide use has led to soil nutrient unbalance in these areas. Poor soil organic carbon (SOC) content is the biggest environmental setback of green revolution technologies. According to a survey of 8 South-East Countries, India is at bottom in SOC content (8.5g/kg) as compared to Malaysia (33.6g/kg), the highest in SOC content. Poor SOC content in India is attributed to extensive mining of soil fertility, low and unbalanced fertilizer use, removal of crop residue for fodder of household fuel/ burning and severe soil degradation. About 130 million hectare land is under different degradation process.

Second, the use of hybrid seeds that require great deal of water for optimal yield had led to drilling of tubewells and large scale depletion of ground water reserves. Subsidy to water and energy add to the problems. According to an ICRISAT study, the trend of over pumping water due to subsidized electricity with insufficient investment in recharging facility has led to an alarming rate of depletion especially in dry land areas. More than 90 percent of open wells in many villages have completely dried up. This has affected agricultural output in long run.

Third, the benefits of green revolution technologies did not reach in several parts of the country. Malnutrition in women and children is continued to remain high, farms are shrinking in size and natural resources are depleting and degrading in quality. Another notable feature of first green revolution is the growing regional disparity in development. Disadvantaged regions, namely hill and mountain, arid, rainfed and coastal did not gain much from the development efforts. A balanced regional development in disadvantaged regions should assume special significance in the planning and development of the programmes in future. The aim should be to enhance productivity, profitability, employment opportunities, knowledge empowerment and enrichment of environment and social values as support system.

Focus of Second Green Revolution:

Should our approach for second green revolution be same as that of first green revolution? The answer is 'No'. It does not mean that approach for first green revolution was wrong. First green revolution using high

yielding varieties, chemicals irrigation, mechanization, mono-cropping etc. brought country from begging bowl to surplus. The growth trend continues for about 2 decades and it is only during last 1 decade, country could not sustain it, rather for few years, the growth was negative. The gains were mainly restricted to irrigated areas. The disadvantaged regions of the country, namely: chronically drought and flood prone, rainfed, hill and mountain, dry land, coastal and tribal areas including islands were bypassed during the first green revolution.

Second green revolution should focus on promotion of rain-fed agriculture where production is mainly confined to coarse cereals and pulses. The issue in rain-fed areas is not water scarcity per se but more important is to use and conserve it more judiciously. The promotion of high value crops may act as a catalyst to bring a second green revolution in rain-fed areas. The efforts should be for integrated approach and packaging of location specific technologies, their testing in the farmers' fields, training the farmers for its adoption with emphasis on efficient management of natural resources. India has inherent comparative advantage of having largest cultivable arable area in the world, rich biodiversity, man power available and scope for special farm products. One should not be perturbed with present agrarian crisis. It is temporary. There are enormous cases of successes in agriculture in the country. There are areas where productivity and profitability have increased and farmers feel proud to attach with their fields. The task of second generation green revolution is to turn problems to successes. The ultimate aim is to develop location specific farming system models and a sustainability plan for long-term gains.

Approaches for Long-term Sustainability:

Second green revolution approach should have clear aims and objectives, time -bound action plan, commitment and support from public and private sector for sustainable solutions. For long-term sustainability, the efforts should be to cover the entire farming gamut. First and foremost step is to critically analyze ongoing programmes / schemes in respect of their performance and expected outcome. The programmes not performing well should be closed. The programmes having duplicate objectives should be merged and re-casted. Benefits and success stories emerged from the completed/ on-going programmes should be synergized and horizontally expanded rather than vertical expansion. All the programmes/ schemes (new and ongoing) should be actionable and affordable. Monitoring and concurrent evaluation is important for achieving maximum benefit of a programme and help in reducing bureaucratic hurdles and corruption. The efforts should be holistic, i.e. water management, use of information technology to improve returns to the farmers, strengthening of extension services, marketing, infrastructure development, provision of adequate power to farmers, protection and enrichment of natural resources, encouragement to off-farm employment opportunities, issuance of reasonable price to farm produce and special focus on small and marginal farmers and mainstreaming gender into agriculture. Emphasis on farmers' income rather than on production only, water harvesting and drainage during kharif and on irrigation in rabi, involvement of farmers from the very beginning so that they feel that it is their programme, are also important for sustainable development. Available opportunities like wide gap between potential and actual yields, many agricultural bright spots, post-harvest technology and value addition, expending group cooperation (on-farm and off-farm) activities through self-help-groups and symbiotic public-private sector partnerships, including farmer-centric contract farming should be explored and capitalized for long-term gains.

There is a need for promoting state level strategies/ farming system models tailored to specific needs of the agro-climatic conditions prevailing in a state to improve farm sector growth from the current 2 percent to 4 percent. India is bestowed with varied agro-ecology, namely hill and mountain, arid, coastal, rain-fed etc. A developmental model for a region should suit to its ecology. For developing models for rain-fed regions/ dry farming, pulses and oil seed crops, livestock, water harvesting, horticulture, agro-processing and value addition are important activities. Main problems of hill ecosystem are water scarcity, soil erosion and dilution of biodiversity. Promotion of high value, income enhancing crops like medicinal and aromatic plants, adoption of water and soil conservation methods and promotion of organic farming to fetch premium price are important activities for hill agriculture. Agro –forestry, culture and capture fishes, conjunctive use of sea and fresh water, forestry and aquaculture, conservation and sustainable use of coastal fresh water aquifers are suitable for coastal eco-system.

Agricultural sustainability cannot be viewed in isolation and need a holistic approach to the issues that make agriculture ecologically sound, economically viable and socially acceptable. Piece-meal relief and temporary solution are not serving the purpose. The plan for long-term sustainability should include 1) Planning activities keeping in view the location specific needs in consultation with all the stakeholders including the farmers so that the farming system models developed ensure benefits to the society and are available for adoption and horizontal expansion for long-term sustainability, 2) Packaging of location specific technologies, their validation in farmers' field and horizontal dissemination of proven technologies, 3) To build partnership, pool competence and resources from conventional and non-conventional resources and build social capital for better ownership and sustainable model for rural development, 4) Developing sustainable models in the less favorable environments and regions through action research, packaging of available proven technologies, technological dissemination including knowledge empowerment, 5) Establishing farmers' Distress Call Centers in each state to provide timely and effective aid to farmers during period of crisis and 6) Generating Agriculture Risk Fund to provide relief to farmers in the case of successive droughts/ floods etc.

Former National Coordinator,
NAIP, New Delhi

REVOLUTIONIZING AGRICULTURE TO COMBAT HUNGER

Dr S K Gupta

Globally, the number of chronically hungry people suffering from prolonged food deficiency is currently 963 million. The developing countries account for more than 93 per cent (901m) of the world's hungry, the UN's Food and Agriculture Organization's (FAO) Dec. 2008 report says. Out of these, 65% almost two-thirds are from seven countries — India, China, Bangladesh, Pakistan, Congo, Indonesia, and Ethiopia— fighting poverty and malnutrition. India alone accounts for more than 20% of the total. Nearly 50% of the world's hungry live in India. The percentage of children under five years of age who suffer malnutrition is a high 47%, compared to the 28% figure for Sub-Saharan Africa, the next worst-off region. Malnutrition accounts for nearly 50% of child deaths here. The first-ever Global Hunger Index 2008 released by the International Food Policy Research Institute (IFPRI) at the close of 2008 has ranked India 66^{th,} out of 88 countries having the largest number of undernourished people 200m in any one country. The overall hunger situation in India continues to be severe, though there are variations across states within country. Madhya Pradesh is worst off with hunger levels comparable to Ethiopia's. Though Punjab's rank in India is number one, it is 33 places below other developing countries on the index.

India is home to the largest number of hungry people in the world, stated in a report jointly prepared at the end of 2008 by the UN World Food Programme and the M S Swaminathan Research Foundation. The report mentioned that the targeted public distribution system (TPDS) as a programme hungry people in India has failed to serve intended goals; it has only led to greater food insecurity for the poor. It attributes the failure of the PDS to its corruption and inefficiency, besides faulty information and wrong assessment of household characteristics and the amount of grain entitlement. In addition to the above, the official poverty estimates don't include calorie deprivation among those who are no longer being classified as being below the poverty line (BPL). This is one of the reasons why a TPDS aimed only at those classified in the BPL category would fall far short of addressing the whole issue of hunger that includes malnutrition, a condition that could lead to stunting, low energy, vulnerability to disease and eventually death.

Global food shortages and higher prices are the cause of malnutrition. By the end of 2009, the number of people who suffer hunger worldwide could swell to one billion, warns the FAO in its Dec.2008 report, - 'The State of Food Insecurity in the World 2008'. Though there has been a sharp drop in foodgrain prices since last year — cereals are now more than 50% cheaper from their peak prices earlier in 2008 — the FAO Food Price Index was still 28% higher in Oct. 2008 compared to Oct. 2006.

At the present contest malnutrition is not a condition that affects only the poor. The rich people, who can afford a better life, live in poor life style— eat foods high in sugar and calories but poor in nutrients Therefore there is a need to address a growing malnutrition incidence that is the upwardly mobile in our society's face.

Crop productivity is already being affected by climate change, largely through more frequent and more severe droughts and also through more floods and storms. An extra billion people will face water shortage, cereal production in developing countries will drop and coastal regions will face more damage from floods and storms.

The tremendous potential of the agricultural sector to reduce poverty has been further weakened by unfavourable macroeconomic policies that led to high and variable interest rates and inflation as well as the erosion of public services such as agricultural extension since the 1980s; the failure of agricultural credit

policies; and the massive scaling down of public investments in irrigation and rural infrastructure. The list goes on. The neglect of agriculture has put enormous pressure on farmers. Low yields, high input prices and low market prices for agricultural produce have led to a vicious cycle of low income and stagnation. Massive scaling down of public services, particularly in irrigation and agricultural extension services, has dealt a blow to the sector. The distress in rural areas is reflected in rising farm indebtedness and suicides in many countries. The figures are tragic and astounding -in India alone, almost 87,000 farmers committed suicide between 2001 and 2005. Unless the neglect of agriculture is addressed, poverty will not be reduced significantly in the region, and inequalities will widen further. In turn, this will jeopardise the economic prospects of our countries and the social cohesion of our communities. The 2008 survey shows that improving agricultural labour productivity could have a profound impact on poverty reduction. Large gains in reducing poverty are also possible through the comprehensive liberalisation of global agricultural trade, with the potential to take another 48 m people out of poverty. Research also shows that raising productivity in agriculture will reduce income inequality significantly.

In China, for example, half of the decline in poverty occurred in the first half of the 1980s when agriculture was given priority. When agricultural development was placed high on the development agenda, poverty declined rapidly in Vietnam, Thailand, Bangladesh, and many other countries in Asia and the Pacific.

Two particularly controversial issues on the international scale are biofuels; energy produced from foodstuffs like maize and vegetable oil, and genetically modified organisms. Biofuels are responsible for 30% of the increase in global food prices, pushing 30 m people worldwide into poverty, aid agency Oxfam said in a report. Both the United States and the European Union have pro-biofuel policies which many food experts say should be reversed. Crops genetically modified to produce higher yields or to thrive in difficult conditions are seen as a possible way to help ease food shortages, but many European countries remain sceptical about them.

During last year to take on the global crisis caused by rising food prices UN Secretary General Ban Ki-moon ordered a top level task force and urged key producer nations to end export bans. He reiterated that immediate priority must be to "feed the hungry" and called for urgent funding for the World Food Programme. In the long-term, the UN chief acknowledged that there is an "urgent necessity to address structural and policy issues that have contributed to this crisis as well as the challenge posed by "climate change" and "the impact of diversion of food crops to bio-fuel production." Biofuels are touted as a way to limit and reduce greenhouse gas emissions, held responsible for global warming, but since they are grown on land that would otherwise be used for food production, they have been increasingly blamed for soaring food prices. The US and the EU have taken a criminal path by encouraging use of food crops to produce bio-fuels and thus contributing to an explosive rise in global food prices.

In the vast continent of Africa, the total harvested area under cereals is 98.7 m hectares, from which about 146 MT of cereals are produced, while in North America (US and Canada) the 71m ha produces 398 MT. They are producing 252 MT more despite cultivating 20m ha less land! In other words, Africa has a vast potential to improve its agricultural production. A similar situation exists in various other parts of the world. This discrepancy is better measured by checking out the yields per ha of land. For every ha of land, China produces 6,265 kg of rice, while Nigeria just 1,440 kg, and India 3,124 kg. Cereal yield per ha is about 4 tonnes in the developing world, while it is over 6 tonnes in the advanced countries. It's not just cereals - in other crops too, there is vast differences. Vegetable production per ha is just over 10 tonnes in Africa and 9.6 tonnes in South-east Asia. But in North America, it is 26 tonnes and in Europe it is nearly 21 tonnes.

The reasons are essentially that in the advanced countries of the West, much more and better resources have been available to the farmers. If similar resources are made available to farmers in India or Bangladesh or Gabon and Burkina Faso, there is no reason why they too will not increase the yield tremendously. And this in turn will provide the much-needed food for their populations. To achieve this would be to resolve the food crisis, as well as the endemic poverty that grips most of the third world. But it requires a monumental shift from the current path of development, and a reordering of priorities, both domestically and internationally.

It was suggested by FAO that cereal production would have to be increased by 50% by 2030 to meet the escalating worldwide demand. Quite simply, agriculture needs another revolution. Increasing agricultural productivity should be at the centre of this new approach. It has become evident that in order to achieve the food production targets of the future a major effort will be required to enhance the seed replacement rates of various crops. It is crucial that the sector's productivity is improved through increased investment in research and development, human capital, extension services, irrigation and rural infrastructure. Land tenure systems need to be revamped, where necessary.

Given its natural limitations, agriculture alone cannot take the region's 641m poor people out of poverty. Therefore, a gradual transition from agriculture should complement productivity improvements - by empowering the poor, particularly women, with the skills to tap labour market opportunities and by promoting rural non-farm activities and regional growth centres. India is endowed with second largest area of farmland, and the largest area of irrigated land, in the world and, with its huge germplasm diversity, its seed industry is well placed to serve both domestic and international markets, provided we trace the latest in the agricultural scenario.

Senior Research Officer, Planning Commission

Excel

Future Outlook

A SURE FUTURE FOR INDIAN AGRICULTURE

Robert de Bos

It is difficult to imagine India having a sustainable growth and development without the agriculture sector. There is a huge rural population who has to earn a living, more than a billion people have to eat everyday and some export would create a welcome foreign exchange income. But the status of agricultural business (cultivation) does not attract investments. Returns are fluctuating and risks are seen as high. True, production management in general is not much developed and also transport, storage and distribution is to be much improved. However, the proposed 70% increase in agricultural output by 2050 to feed the world population, as mentioned by the FAO, does not mean a revolution for India. It is just steps wise improvements of less than 2% per year. At present there is scope enough for much larger increases in several sectors, especially the high value crops of horticulture and floriculture. Of course there are many examples of high standard, professional farming of high productive crops and not only commodity goods, but also several productions as fruits and vegetables. With the inclusion of the other sectors and especially the smaller rural farmers, agriculture could become a motor for economic growth, not only when monsoon is good!

Understandably governments have been on this issue; from various angles many attempts have been made to improve the situation. There is however, in my opinion, not a comprehensive program; maybe in overall policy, definitely not in implementation. This may find its roots in existing mindsets in social structures, institutions and politics, at all hierarchic levels of these entities. Often the structures and schemes, although fragmented, are commendable, but it is the lack of performance and final results, whatever the reason may be, that make these programs fail.

Some other countries where agriculture development has taken place may provide good suggestions. Colombia in South America has developed large parts of its agriculture through practical research (read: professional cultivation), extension of these results to the farmers in turn linked to credit to implement the schemes, all in one program. The program was moreover executed very strictly on all fronts; program directors, extension workers and farmers had clear responsibility. Israel, after adopting foreign technologies and further developing them over a long period to make them their own and improve them, has been able very quickly to get small producers together for central grading and marketing. Also the immigration of its habitants from all over the world since the establishment of the State, brought in a huge knowledge base. Countries like Australia, Brazil, Colombia, Kenya and recently Ethiopia allowed and invited foreigners with good knowledge to start specific productions like horticulture and floriculture. In a relatively short period (10 to 15 years) this knowledge became national property.

All these examples demonstrate that first the right professional practices have to be accepted, then adjusted and finally passed on to farmers. Only years of cultivation will result in valuable experience. There is no other way to learn, but support from global knowledge is extremely important, it makes learning much faster. The recently proposed cooperation between the USA and India in the field of agricultural research is a positive development, but let it be practical, in the line of extension to the farmers. Practical research does not mean inventing the wheel; it is in most cases adopting an existing cultivation protocol, executing it with preciseness. The results will provide valuable information about possible adaptation of the cultivation protocol, to make it a 'home version'. Ultimately, this is the process of science; a continued process of trials> results> analysis> conclusions> new trials.

Although research has to be done in many fields for the future, at present the priority lies in finding and implementing the practices of the professional cultivation in the field. Pure scientific research is of lower priority at present.

In regard to the adaptation of cultivation practices from other countries, it is interesting to see, that often a crop or growing procedures imported from another country undergoes serious scrutiny, but when we shift the same from South India to the mountainous North it is often accepted without adjustment.

Horticulture Departments or Universities could undertake this work of empirical research; high commitment is required, because the experimental cultivation has to be successful. Once the procedures are worked with, it has to be transferred to the potential growers at a very practical level. The results of experimental cultivation and further research from all entities have to be brought together under a committee with representatives of all entities delivering their findings. This information will be analysed and valued, then compared and complemented with global research results. Some results will need confirmation by practical implementation. It will then form part of the standard guidelines for extension. This research takes often already place through the various national committees, but these various committees are not putting their findings together, hence still there is fragmentation of knowledge. It would be a good step to get a 'national coordinating knowledge-pool committee' in place.

It is well agreed on that many an agriculture activity has to be lifted to higher levels of productivity, especially for small farmers. That is higher output per square meter of crops, also traditional crops. There is no merit to be the largest producer, for the single reason that more land is under cultivation. In-depth investments are required!

There are several ways to achieve this higher production:

1. Creating better, more controlled conditions. Wind breaks, shade nets, net houses or green houses and tunnels, precise irrigation systems, etc.
2. Improved plant material and suitable varieties
3. Improved cultivation techniques and management
4. Intensive cultivation of crops with higher value
5. Maximised plant density
6. More continued production, minimized fall periods.
7. Cost efficient, but not necessarily cheaper production. The right investment is paid back by more or better products …….and to ensure maximum price:
8. Getting all products in good condition in hands of the consumer, through the minimum number and only professional channels

That is quite an agenda, but with governments, both Central as well as the States, willing to spend money in the form of subsidies, the costs for point 1 and 2 will be alleviated. However, a green house in itself is not producing more or better, you have to be told what can grow and how to grow. Ultimately, extra production is essential, firstly to return the money to pay for the facility and extra equipment, secondly to comply with the objective to increase the income of farmers. Traditional growing methods do not. This is not to demean traditional growing, but recognizing that, as any other industry, agriculture also has undergone transformation and the gap between former and present is getting larger and larger.

That brings us to the points 3, 4, 5 and 6. The grower has to be informed and technically assisted. For this, extension officers in the field are required. Persons, not only with a certain degree, but more importantly with practical experience, able to work with growers in the field. The extension worker has to understand that the growers have to make a change of mind and attitude and help them with this. Hi-tech-, intensive- or green house- cultivation is much more a factory job than a traditional agricultural activity. Precise, efficient, effective and in-time are the management words for this work.

It is an understatement to say that finding large numbers of personnel for the job of extension is a huge undertaking. Teaching and training all these extension workers is next, hence the development of a curriculum is necessary, a task for an international oriented institute. This

is typical a train-the-trainers program. Without extension services, now(!), we face the risk that green houses are standing empty, because farmers are disappointed with the initial results, do not know what to plant and do not have money to pay the bank. This situation is real and occurring already.

For now the extension is done by private persons as advisers and consultants and company's sales personnel. Amongst them there are some highly qualified professionals, but also, too many, inexperienced persons. Together this creates a confusing situation for the farmers, and for anybody else. Often advices are biased.

Market

Effective and practical marketing of special agri-products in India cannot be done by an institute; these institutes cannot do more than collection of products, central grading (standardization) and maybe a minimum price fixing. A function that cannot realistically be done by a private organization, is a country wide promotion of the product and education of the consumer. Organisations as Marketing Boards and APEDA could have a task here.

Then what is left is the segmentation of the market. This subject is picked up in horticulture and floriculture produce by private companies. So far not very successfully, due to lack of regular supply and that of higher standard products and on the other hand, the lack of price stimulus for the grower to improve.

In line with the above, hi-tech floriculture has seen it all.

The hi-tech floriculture is one of these agriculture activities of intensive cultivation, which has gone through the process of acquiring and implementing know-how. In the early nineties it was presented as a high investment, high income business. Because of purchase of highly sophisticated facilities and equipment (and more!), it was indeed high investment. But automation does not take over expertise and professional knowledge and hence many things went wrong. The result was low production and low quality and hence income was low, far too low to justify the investments. Extension of square meters for production was not the solution, because production per square meter was low. The industry looked at it from the point of view of too high production cost instead of too low production results and went in a phase where costs were cut. Costs were cut so deeply that production was hardly possible and definitely at the cost of quality. Some early entrepreneurs closed down, others who survived had financial problems. At present, a number of early established companies that became successful, are joined by companies that were established from 2000 onwards. These became more successful, making use of former experiences.

Surprisingly India is in one of the better positions for future floriculture (and horticulture). Whereas countries like Kenya, Colombia, Israel and others have lost their elasticity in continued improvement of efficiency in the business, i.e. investments with good returns (new varieties, new technologies), labour efficiency and productivity, production levels in quantity and quality, etc., India has still a large scope of possible improvement in any of these fields. However, we have to accept that learning is not anymore restricted for the younger people, but has become a lifelong activity. With an open mind, it is quick learning using knowledge globally available. There are other positive points. Together with only some western countries, India can export, but also has a strong local market. Subsidies are available. Governments are investing in the industry by subsidizing total project establishments, green houses, plant material, etc., even if it is sometimes cumbersome to qualify for these funds and funds are not fully available for the project. In many areas individual farmers have set up or are setting up small scale floriculture. This un-organized sector is an opportunity and potential for progressive entrepreneurs, who are able to set up in larger scale.

Important note : To be successful, everybody in the flower and vegetable production has to follow precisely the cultivation practices and post harvest handling, without compromise, because the world sets its standards higher and higher, every day.

MD and CEO,
Bangalore Plant First

किसानों की हर जरूरत के लिए अनूठा

पीएनबी कृषि कार्ड

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- निजी आवश्यकताओं जैसे कि शिक्षा, चिकित्सीय व्यय, घरेलू वस्तुओं की खरीद आदि रोजमर्रा की जरूरतों के लिए
- सम्बद्ध कृषि कार्यकलापों के लिए कार्यशील पूंजी
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सर्वोत्तम	रु. 3,00,001 – 5,00,000
स्वर्ण	रु. 5,00,001 – 10,00,000

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