Contents

List of figures

List of Boxes

List of Tables

Preface

The report covers the activities of the Centre for the year 1999-2000. This was a year of consolidation and take off. The Centre has started playing a leading role in the field of agricultural economics in the country focussing on research and policy issues of contemporary importance. The participation of the Centre in policy interfacing activities has strengthened.

Technology policy is one of the important research areas of the Centre. During the year, studies on research resource allocation, prioritisation of production constraints, impact of research on poverty, integrated pest and nutrient management, etc. were completed. The findings will be useful in research policy in particular and agricultural policy in general. Sustainability of agricultural systems is another concern, where this Centre is trying to develop indicators of sustainability for different production systems. During the year the Centre has made significant contributions in the area of marketing and trade. A study conducted on impact of trade liberalisation on agriculture brought out that India would gain in some crops and lose in some others on implementation of WTO agreement. The findings of some other studies related to agricultural investment, regional disparities and institutional aspects of agricultural development are also noteworthy. The Centre initiated some new in-house as well as collaborative projects with international and national institutions.

The budget for construction of office building and staff quarters has been approved in the Ninth Five Year Plan. The Building plans have been finalised and the necessary approvals from civic authorities are being expedited. Library of the Centre is being strengthened with emphasis on information repository and sharing.

Dr. P.S. Birthal has compiled this report with the help of Dr. P.K. Joshi, Dr. Ramesh Chand, Dr. B.C. Barah, Dr. Sant Kumar and Mr. Badruddin. Ms. Umeeta Ahuja has prepared the manuscript for printing. I am thankful to them and other colleagues who have contributed to this effort.

March, 2000 Dayanatha Jha
New Delhi Director

Executive Summary

The National Centre for Agricultural Economics and Policy Research (NCAP) was established by the Indian Council of Agricultural Research (ICAR) in March 1991. The Centre is located at the campus of the Indian Agricultural Statistics Research Institute (IASRI), a sister institute of ICAR and is adjacent to the Indian Agricultural Research Institute (IARI), a premier institute in the country. The Centre has at present twenty scientists, and sixteen other staff. It had a total budget of Rs.265.45 lakhs for the year 1999-2000.

A high level Research Advisory Committee (RAC), comprising eminent professionals outside the system, guides the Centre in its research policies. Dr. S.S. Johl is the current chairman of the RAC. The Centre has also a Management Committee (MC). A number of internal committees, such as Staff Research Council (SRC), Budget and Policy Committee, Official Language Committee, Consultancy Processing Cell, Grievance Cell, Women Cell, Institute Joint Council, etc. have been constituted for decentalised management. Quinquennial Review Team has recently been constituted with Dr. V.S. Vyas as chairman.

In consonance with the mandate of the Centre, there are five major research themes viz. technology policy, sustainable agricultural systems, markets and trade, institutional change and agricultural growth and adjustment. The research is underway in each theme. Major achievements of the completed and ongoing research studies are summarised below.

A study was undertaken to examine the pattern of research resource allocation in rainfed agriculture. The study revealed that in the rainfed ecoregion, 40 percent of the research resources should be earmarked for the rice-based production system, 27 percent for the oilseeds-based production system, 22 percent for the coarse cereasls-based production system and 11 percent for the cotton-based production system. Across different production systems, besides dominant crop, the two most important activities viz. dairy and horticulture need higher share in research resources. In the arid ecoregion, livestock should receive higher share, followed by oilseeds and cereals.

One of the important considerations in research in India has been to improve upon income distribution and reduce incidence of poverty. The investment made in agricultural research in different states was negatively correlated with the incidence of poverty, which implied that the benefits of research had percolated down to the poor people. In a related study it was observed that research has generated substantial gains in land and labour productivity. However, land-augmenting technical change has slackened in relation to labour-saving technical change. This does not augur well for small and poor farmers. The study suggested more vigorous efforts to break the land productivity barriers.

In a study on 'crop diversification in rainfed agriculture' it emerged that rainfed agriculture is highly diversified, but the cropping intensity was low and witnessed very slow growth. The growth in cropping intensity was largely due to introduction of new crops. Development of irrigation facilities and watersheds along with moisture conservation techniques and bio-mechanical technologies (tractorisation, drought resistant and short duration varieties) would help increase cropping intensity and productive potential of rainfed agriculture.

One such example is the emergence of short duration and drought resistant chickpea varieties in non-traditional hot and dry climate in Andhra Pradesh in recent years. Area expanded sharply, contributing to the output growth substantially. The area under chickpea cultivation came mainly from fallow/marginal lands. It also occurred through substitution of rabi sorghum. Higher yield instability of sorghum and slow increase in its yield and prices relative to chickpea had a positive influence on spread of chickpea cultivation.

Accumulating evidences indicate that there is an ample scope to raise agricultural production in both the rainfed and irrigated regions. Studies were initiated to identify the factors hindering the realisation of the production potential in different production systems. In the soybean-based production system, agricultural output worth Rs. 21106 million was lost in 1999. In groundnut based production system, the annual losses due to biotic and abiotic factors were estimated at Rs. 32023 million. Non-podding in soybean, water stress in wheat and heavy infestation of pod borer in chickpea in the soybean-based production system, and problems of weeds and insect pests in the groundnut-based production system were identified as the limiting factors. These need to be addressed through research on soil and moisture conservation and breeding of short

duration, drought and pest tolerant crop varieties. The socio-economic factors that were somewhat common in different production systems include erratic input supplies, lack of access to institutional credit and insurance and high price risk. These need to be alleviated through policy.

In contrast to the general perception that at existing level of technology, there is little scope to raise production in irrigated ecoregions, results of a study from Haryana are revealing. About half of the existing production potential remains untapped due to problems of insect pests, weeds, poor seed germination, imbalanced use of fertilisers and some socio-economic factors such as erratic power and input supply and labour scarcity. To sustain the growth of irrigated agriculture, research priorities need to be oriented towards breaking the yield barriers through development of insect pest resistant varieties and mechanical devices suitable for small holder agriculture.

These findings are supported by another study that examined the efficiency of chemical fertilisers and the integrated nutrient management using data from studies on long-term fertiliser experiments. The response of paddy and wheat yields to sole chemical fertiliser application was found less and decelerating, compared to combinations of fertilisers with organic sources of nutrients. Another study based on experimental data found that the optimal quantity of water (53 cm/ha) at different crop growth stages and 120 kg nitrogen/ha could yield 6 tonnes/ha of wheat in Punjab.

Pesticides too have contributed to increased agricultural production in India. Because of technological failure and adverse effects of chemical pesticides on ecology and society, integrated methods of pest control are proposed and claimed to be compatible with the objectives of a productive and sustainable agriculture. The results of a farm level study, with rainfed cotton as a case, support these claims. Application of integrated pest management (IPM) method reduced pesticide use almost to nil without any reduction in the yield. The cost of production as well as plant protection could be reduced by about 20 percent. IPM was a labour-using method implying that widespread adoption of IPM practices would generate additional employment opportunities on and off the farm.

A study was undertaken to examine the issues of growth and sustainability of brackishwater aquaculture. Brackishwater aquaculture witnessed an unprecedented growth in early nineties. The momentum could not last after 1994-95. Area kept on increasing; the yield came under pressure owing to negative externalities of intensification to the ecology, society and the system itself. Aquaculture was legally banned in the coastal regulation zone. The corporate investment declined. All these factors contributed to the decline in production and yield. The investigations, however, show that there exists enormous potential to raise brackishwater aquaculture production through area expansion alone, as at present hardly 17 percent of the available brackishwater area in the coastal states is under aquaculture. Appropriate production management consistent with principles of ecology conservation would help realise this.

Management of traditional irrigation systems is crucial to sustained growth of agricultural sector. In a study of Andhra Pradesh tank irrigation system, it was observed that neglect of minor irrigation sector had led to deterioration of tank irrigation. The tanks are an important source of irrigation in the rainfed regions and for the marginal and small landholders. Improving performance of tanks would help alleviate inter-regional and inter-farm disparities. Irrigation reforms have been initiated in the state at grassroots level by involving farmers in management of irrigation systems.

The on-going economic reforms emphasise privatisation and partnership. To assess the feasibility of privatising agricultural extension, the results of a study showed that the participation of private sector was limited to few crops in select geographical regions. The performance of the public extension system was poor, and about half of the surveyed farmers, particularly in the high-income brackets and growing horticultural crops, were willing to pay for extension services especially for plant protection and training.

Fertiliser is a crucial input in crop production. The future demand for fertiliser is expected to rise with the intensification of agriculture. The results of a study indicate that India would need about 265 million tonnes of NPK by the end of 2007.

In recent years, private sector has entered the seed market. However, the flow of information to farmers about seed attributes remains limited. Information flow takes place largely through the farmer-to-farmer contacts. The study suggests that the public sector should strengthen information system on seed quality, regulatory

mechanisms, etc.

In the context of globalisation process of Indian economy, a study was initiated to assess the impact of implementation of WTO agreement on agricultural sector. The results revealed that implementation of WTO would have a mixed impact. The net returns from paddy would increase by 18 percent. However, removal of subsidies would lead to a decline in income by 11 percent. Trade liberalisation would be highly favourable to maize and the net returns would increase by 81 percent. The negative effect of removal of subsidies would be more than offset by trade liberalisation. The impact of liberalisation, however, would be negative on rapeseed-mustard.

Livestock trade is another gray area worth exploring. In a study, it was found that there is a sufficient potential to raise exports of livestock products ' particularly leather and leather products, and meat and meat preparations. In a related study, the impact of Southeast Asian economic crisis was assessed on India's livestock sector and it was observed that though the share of Southeast Asian countries in India's exports of agricultural sector has been affected marginally, it did not have any significant impact on exports of livestock products.

A study was undertaken to diagnose the status of nutritional security of farm households using NSSO data. With 2300 Kcal/caput/day as the cut-off limit, about 29 percent of the rural households were found to be undernourished. The nutritional security was better in the rice-wheat and wheat-based cropping systems, compared to rice and coarse cereals-based cropping systems. The nutrition intake was also found to be influenced positively with the increase in the level of irrigation. Ownership of dairy animals too influenced the nutritional intake positively. These imply that improved agricultural technologies have helped increase calorie intake of the farm households. Though the small farm households were found to be vulnerable in general.

The demand for high value commodities is likely to increase with the sustained rise in per capita income. The market for such commodities however is limited to households in the upper income brackets. This was observed in a study on shrimp consumption behaviour of urban households of Chennai city. The consumers were willing to pay about 25 percent more for the desired attributes. Shrimp is basically an export item, the study suggests exploring domestic markets for such products in order to provide sustainability to shrimp production, in case the exports face problems from the importing countries.

A study conducted in Uttar Pradesh showed that agricultural diversification towards high value crops has sufficient potential to generate income and employment opportunities. Concerted efforts to improve infrastructure for storage, marketing and transportation and strengthening the extension efforts for horticultural crops would help increase area under horticultural crops. In order to examine whether the developmental efforts have reduced the regional disparities in agriculture between different states, the results of a study indicated increasing disparities in per capita agricultural income across the states. The growth in per capita agricultural income was negative in the low-income states viz. Assam, Bihar, Himachal Pradesh and Orissa. On the other hand, per capita agricultural income has grown faster in the higher income states. Another study that analysed the growth and variability in rice production in eastern India indicated that except Bihar, there has been significant growth in production and yield of rice in recent years. The yield, however, is still about half of that in northern region.

Punjab has been in the forefront of agricultural development. However, in recent years the growth of agricultural sector in the state has started decelerating owing to natural resource degradation and limits to growth. The growth rates in net state domestic product, net state domestic product from agriculture and per capita income have come below the national averages. Thus, in order to accelerate the growth, the study suggests diversification of agriculture towards high value commodities such as horticulture, floriculture and dairying in different agro-ecological regions based on their comparative advantage.

In a study on temporal and spatial pattern in agricultural investment, it was observed that the investment in agriculture slowed down in most of the states. Investment as a proportion of net domestic product has also been declining. There was substantial variation in per hectare private fixed capital formation across the states. The results further revealed lack of complementarity between public and private investment. Institutional credit flow and terms of trade for agriculture were identified as the main determinants of private investment in agriculture and output growth. The study, therefore, suggested to encourage private investment through institutional credit support to sustain the growth in agriculture.

Two Policy Papers and five Policy Briefs, two Workshop Proceedings and two PME Notes have been published during the year 1999-2000. Centre's staff has also been involved in a number of professional and policy-level interactions.

I Introduction

The National Centre for Agricultural Economics and Policy Research (NCAP) was established by the Indian Council of Agricultural Research (ICAR) in March 1991, to strengthen agricultural economics research in the national agricultural research system comprising ICAR, its affiliated institutions and the state agricultural universities (SAUs). The mandate of the Centre includes:

- Policy oriented research on: (i) technology generation, diffusion and impact; (ii) sustainable agricultural production systems; (iii) interaction between technology and other policy instruments like incentives, investments, institutions, trade, etc; and (iv) agricultural growth and adjustments.
- Strengthen agricultural economics research and teaching capability in the state agricultural universities and ICAR institutes.
- Enhance ICAR participation in agricultural policy decisions through policy-oriented research and professional interactions.

Location

The Centre is located at the campus of the Indian Agricultural Statistics Research Institute (IASRI), a sister institute of ICAR, and is adjacent to the Indian Agricultural Research Institute (IARI), a premier research institute in the country. This offers locational advantage to the Centre in terms of opportunities for inter-disciplinary interaction as well as access to library, computational and other infrastructural facilities available at these institutes.

Faculty

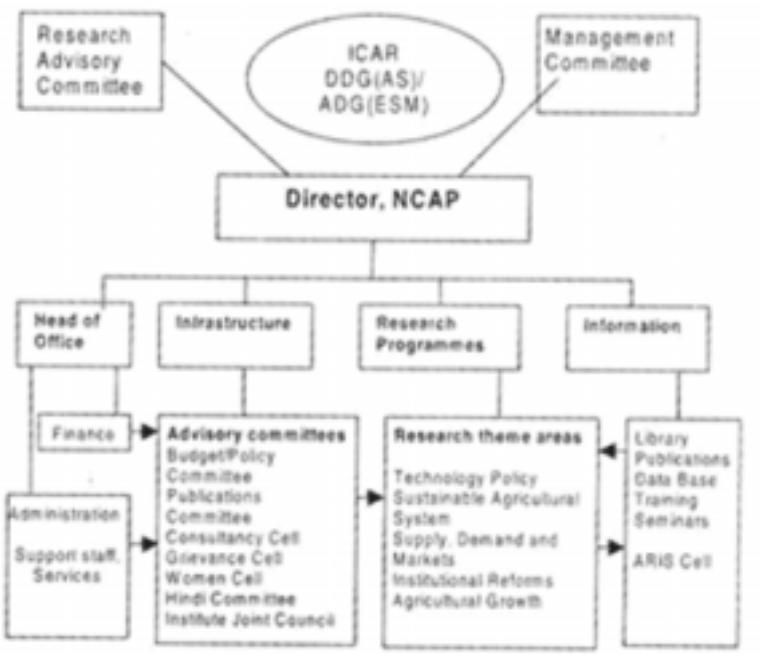
The Centre has at present twenty scientists. This includes the Director, one National Fellow, four Principal Scientists, four Senior Scientists and ten Scientists.

Management

A high-powered Research Advisory Committee (RAC), comprising mostly eminent professionals outside the system, guides the Centre in its research policies. Prof. Y.K. Alagh, former Minister of State for Power and Science and Technology, Government of India and presently Member of Parliament (Rajya Sabha) was the first Chairman of the RAC. Currently, Prof. S.S.Johl, an eminent agricultural economist, is the Chairman. Planning, research thrusts and strategies, initiatives in human resource development, approaches to improve policy dialogues and evaluation, are being guided by the RAC.

The Centre is supervised by the Management Committee (MC), as constituted and mandated by the Council. A number of internal committees, such as Staff Research Council, Budget and Policy Committee, Computers Committee, Official Language Committee, Library Committee, Publications Committee, Consultancy Processing Cell, Grievance Cell and Women Cell have been constituted for decentralised management. The Institute Joint Council promotes healthy interaction and proper work environment.

Organogram of NCAP



II Research Achievements

Research achievements under major programme areas of the Centre during the year are given below.

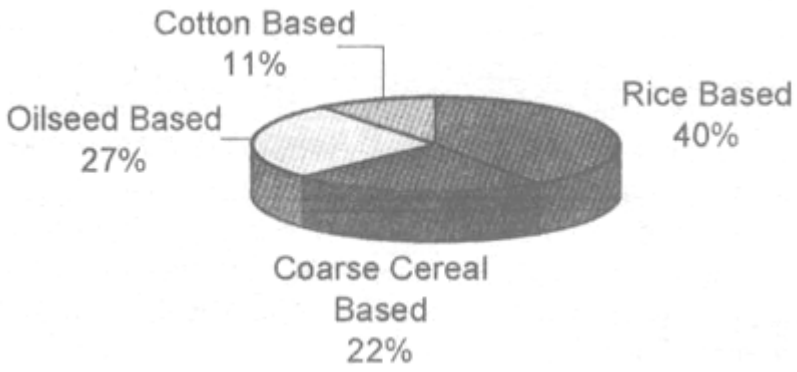
TECHNOLOGY POLICY

Research Priority Setting

Dayanatha Jha

An exercise was undertaken to delineate, map and characterise the agro-ecoregions and production systems identified under National Agricultural Technology Project. The Arid, Coastal and Hill & Mountain agro-ecoregions as identified by National Bureau of Soil Survey and Land Use Planning were retained as such. The remaining districts were further delineated into rainfed and irrigated agro-ecoregions. The districts having less than 40 percent gross irrigated area were classified as rainfed districts and remaining districts formed the irrigated agro-ecosystem. It was implicitly assumed that all agro-ecological and socio-economic factors were reflected in the cropping pattern. Cluster analysis was used to delineate different production systems. Different clusters were formed based on share of major crops in total gross cropped area. After delineating production systems, agro-climatic, demographic and socio-economic features were studied to understand the existing scenario and further potential for growth. Research resources were allocated at different levels across production systems in Rainfed and Arid Agro-ecosystems (Figure 1).

Figure 1 : Research resource allocation in rainfed agriculture



Consideration of sustainability and equity shifted allocations in favour of rice and coarse cereals-based production system in Rainfed ecoregion and pearl millet production system in Arid ecoregion (Table 1).

Table 1: Research resource allocation across commodities within different production systems of arid ecoregion

Commodities	Research resource allocation (%)			
	Overall	Pearlmillet-rapeseed system	Pearlmillet-groundnut system	Pearlmillet system
Cereals	25.07	24.49	14.07	33.54
Pulses	3.67	4.17	2.61	3.14
Oilseeds	25.39	28.17	29.05	16.32
Fruits	1.84	0.60	8.12	0.80
Vegetables	2.68	3.11	2.46	1.77
Cotton	0.85	0.45	3.31	0.22
Livestock	40.45	38.65	40.10	44.21
Share in total	100.00	47.50	16.80	35.50

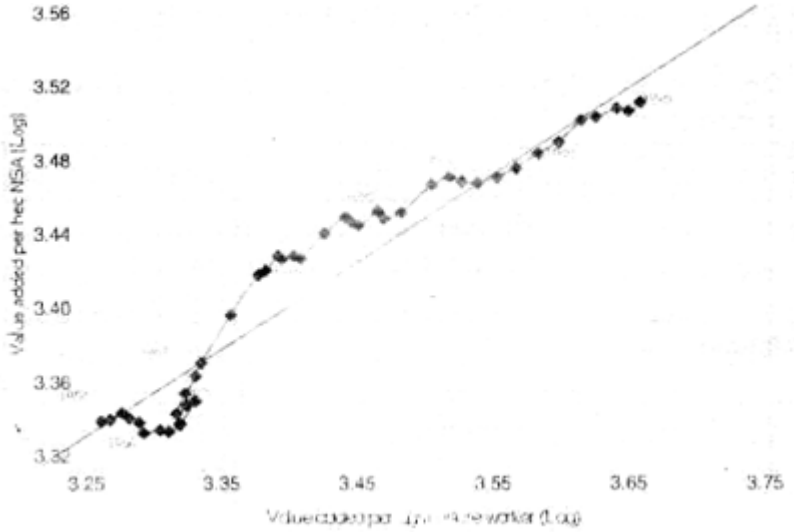
Small Farms and Agricultural Research

Dayanatha Jha

Indian agriculture has been characterized by acute land scarcity. Average farm size has been going down, as population pressure on agriculture remains oppressive. Very slow growth in non-agricultural employment has impeded structural transformation of Indian agriculture. Relative factor scarcity dictates land-augmenting and labour-using technical change. This is consistent with both growth and equity objectives.

The time-path of agricultural growth in the country is depicted in Figure 2. It shows substantial gains in land and labour productivity in the post-Independence period. It also shows that there is a distinct phase of rapid gain in land productivity coinciding with the green revolution. Subsequently, growth in labour productivity appears to have been relatively stronger. This pattern is consistent with the historical pathway in other land-scarce countries in Asia. What is notably different is that in other land-scarce Asian countries, there has been a concomitant increase in land-man ratio and rapid decline in agricultural labour force. In India, on the other hand, the land-man ratio has deteriorated. The turnaround in the growth curve since the eighties is somewhat disturbing because it implies a relative slackening of land-augmenting in relation to labour-saving technical change. This may have arisen from several sources. The supply of land-augmenting technology (seed-fertiliser, irrigation) has slackened. In addition, intensification of agriculture has led to accentuation of seasonal and operation-specific labour scarcity. These factors coupled with low (subsidised) price for energy and machinery may have opened a labour-saving pathway. Labour-saving mechanical devices are being increasingly adopted for all energy intensive operations even on small farms.

Figure 2 : Time path of agriculture growth in India



This does not augur well for small and poorer farmers. More vigorous efforts are needed to use frontier science to break the land productivity barriers. In context of relevance to small farm systems, several research related issues are raised. These include factor bias, stability, natural resource management, efficiency, frontier science, value-addition, product profile, institutional change, and role of private sector.

Impact of Agricultural Research on Poverty

P. K. Joshi, Suresh Pal and N. P. Singh

The study develops a framework to assess impact of research investment on poverty and provides some preliminary estimates. To conceptualise the framework, the research investment was related with the spread of new research outputs such as adoption of high yielding varieties, use of chemical fertilisers, irrigation, etc.

The correlation between research investment and spread of high yielding varieties, irrigated area and fertiliser consumption in all the states and union territories was negative and significant (Table 2). Besides, a strong negative association exited between poverty and development programs and literacy. In majority of the states, investment in agricultural research, with different lags, had facilitated alleviating rural poverty. The results suggest that rainfed regions and some of the eastern parts of the country need special efforts to alleviate poverty through research and other programmes. A mechanism has been designed to incorporate poverty or equity as one of the objectives of the agricultural research to screen and prioritise research portfolio. Further investigations are in progress.

Table 2: Correlation coefficients of poverty with key poverty alleviation strategies

State/Union territory	Correlation coefficient with extent of poverty		
	Research investment	Rural development programs	Literacy
Andhra Pradesh	- 0.74	- 0.82	- 0.81
Assam	- 0.86	- 0.77	- 0.95
Bihar	- 0.59	- 0.36	- 0.60
Gujarat	- 0.74	- 0.77	- 0.81
Haryana	- 0.47	- 0.77	- 0.51
Himachal Pradesh	- 0.02	- 0.28	- 0.35
Jammu & Kashmir	-0.73	- 0.70	- 0.88
Karnataka	- 0.77	- 0.85	- 0.82
Kerala	- 0.85	- 0.56	- 0.91
Maharashtra	- 0.72	- 0.60	- 0.74
Madhya Pradesh	- 0.77	-0.84	- 0.87
Orissa	- 0.88	- 0.82	-0.93
Punjab	- 0.68	- 0.71	-0.65
Rajasthan	- 0.90	- 0.79	- 0.91
Tamil Nadu	-0.92	- 0.88	-0.95
Uttar Pradesh	-0.62	-0.64	-0.73
West Bengal	- 0.93	- 0.95	-0.97

Prioritisation of Production Constraints

Studies were initiated to identify and prioritise the constraints hindering realisation of growth potential of different production systems. Salient findings are reported below.

Sorghum-based Production System

A. K. Jha

The sorghum based production system (SPS) occupies 9 percent of the total geographical area and shares 33 percent of the total cropped area of the country. It supports more than 8 percent of the country's population. The cropping intensity of SPS is merely 118 percent as against the national average of 132 percent.

Sorghum occupies 32 percent area of the SPS. Nearly 36 percent of this falls under kharif sorghum and rest comes under rabi sorghum with the corresponding production of 57 and 43 percent. Apart from sorghum, crops like rice, pigeon pea, castor, sunflower, cotton, and groundnut were also important, but the yield levels of these crops were about half of the potential yield (Table 3). A number of technical and socio-economic constraints generate

huge annual production losses. The annual production loss was valued at 12.99 and 6.88 million rupees for kharif and rabi sorghum, respectively. The losses in groundnut crop were to the tune of Rs. 2.87 million. The losses in cotton and sunflower were almost close to three-fourth of a million, while pigeon pea, rice and castor accrued estimated production losses of Rs.0.30 million, Rs.0.28 million and Rs.0.15 million, respectively.

Table 3: Yield gaps in various crops in sorghum-based production systems (Kg/ha)

Crops	Potential yield	Attainable yield	Actual yield	Yield gap I	Yield gap II
Sorghum kharif	1727	1464	723	263	741
Sorghum rabi	1727	1531	683	196	848
Rice	6352	5197	2649	1155	2548
Pigeon pea	1730	1525	519	205	1006
Castor	2716	1773	469	943	1304
Ground nut	3368	1853	1272	1515	581
Cotton	1720	1685	1174	35	511
Sunflower	1767	1401	827	366	574

Yield gap I = potential yield -attainable yield.
Yield gap II = attainable yield-actual yield

Further analysis revealed that in order to achieve sustained growth of this system, priority needs to be accorded to moisture conservation and enhancing the irrigation potential of the region. Development of stress and drought tolerant varieties needs to be emphasised. The optimal mix of Integrated Pest Management and Integrated Nutrient Management technologies is another area of promise.

Soybean-based Production System

Anjani Kumar and A. K. Jha

Soybean-based production system constitutes 57 percent of the country's total soybean area and contributes only 34 percent to its total production. The average productivity of soybean in the system is merely 880 kg per hectare. Wheat, chickpea and potato are the other important crops. Dairying is an important activity, which bears strong effect on the household income. Substantial gaps exist (Table 4) due to a number of technical and socio-economic production constraints. Losses worth Rs. 21106 million were estimated considering soybean, wheat, chickpea and potato crops.

Table 4: Yield gaps in various crops in soybean-based production system (kg/ha)

Particulars	Soybean	Wheat	Chickpea	Potato
Potential yield	2625	5650	1820	23000
Attainable yield	2071	5226	1617	21500
Actual farm yield	1491	2625	842	14330
Yield gap I	554	424	203	1500
Yield gap II	580	2601	775	7171

Among various constraints, non-podding in soybean, which is a recent problem, was found to be the most serious, whereas moisture stress in wheat ranked first among all the production constraints. The next important production constraint was infestation of pod borers in chickpea. Hence, it is important to determine research priorities in accordance with the severity of the constraints in the system.

Rainfed Groundnut Production System

B. C. Roy and R. L. Shiyani

Groundnut is the principal vegetable oilseed crop in India grown mainly under rainfed conditions. The productivity is rising gradually, but it is restricted to the better environments. In harsh environments, not only the yield is low, but also fluctuates violently. The study undertaken in Anantpur district of Andhra Pradesh and Rajkot district of Gujarat quantifies annual losses due to major biotic and abiotic constraints (Table 5). At the system level, these are valued at Rs. 32023 million, which is more than 80 percent of current value of output groundnut system. Among biotic factors Cynodon weed tops the list followed by Spodoptera, problem of aflatoxin, celesia, leaf miner, stem rot, poor seed viability, red hairy caterpillar, bud necrosis, grubs, tikka, rust, and Helicoverpa. Important abiotic constraints are water stress, poor soil fertility and low plant population followed by late sowing, imbalanced use of fertilisers and waterlogging. Socio-economic constraints are related to irregular and inadequate supply of quality inputs. Fear of crop failure and problems related to unorganised marketing is another set of constraints.

Table 5: Estimated yield losses due to major constraints in groundnut (Kg/ha)

Constraints	Anantpur (Kharif)	Anantpur (Rabi)	Rajkot (Kharif)
Insects	103.15	71.74	140.49
Diseases	72.18	67.33	113.13
Weeds	62.92	69.05	104.39
Soil related	54.45	33.32	10.22
Water related	61.1	20.28	53.29
Others	99.48	101.39	18.25
Technical	453.28	363.11	439.77
Socio-economic	304.72	169.89	289.81
Total	**758.00**	**533.00**	**729.58**

Possible research interventions include application of biotechnology and resistant breeding to develop new cultivars with multiple resistance to various biotic and abiotic constraints. On policy front, the need is to strengthen flow of rural credit and insurance facilities. Transfer of integrated pest and nutrient management packages need to be emphasised.

Rainfed Cotton Production System

Sant Kumar

Cotton production is being confronted with a number of technical constraints. To identify these technical constraints and prioritise them on their economic importance, a study was carried out in Yavatmal district of Maharashtra during 1998-1999.The magnitudes of estimated yield gap I and II in cotton were reported to be 463 kg/ha and1066 kg/ha, respectively. The total yield loss due to technical constraints was 512 kg/ha and accounted for larger proportion of estimated yield gap (Table 6). Sorghum is an important crop in this system. Sorghum yield gap I and II were observed to be 342 kg/ha and 776 kg/ha, respectively. The total yield loss from technical constraints was 490 kg/ha. Stem borer, weeds, nutrients deficiency, ergot, shoot fly and head fly were the most important constraints in sorghum. With regard to livestock production constraints in the system, H .S., Black Quarter, F.M.D., were found important. Non-availability of quality inputs and resistant varieties, lack of proper technical guidance, problems of credit and low output price were the main socio-economic constraints.

Table 6: Yield losses in cotton, 1998-99

Constraints	Estimated loss (Kg/ ha)	Percent of total
Insects	154.29	30.11
Other causes (drought, germination, etc.)	129.11	25.20
Diseases	79.68	15.55
Weeds	75.26	14.69
Nutrient deficiency	42.48	8.29
Soils problems	31.59	6.16
Total	**512.41**	**100.00**

Rice-Wheat Production System

B. C. Roy and K. K. Datta

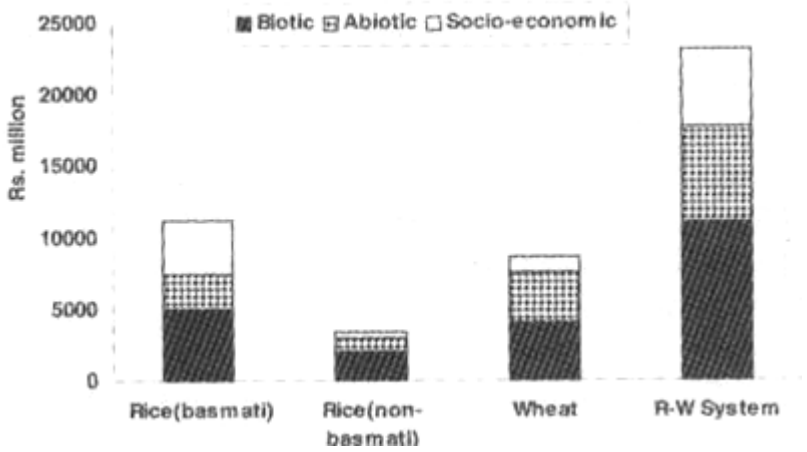
Rice-wheat crop sequence has emerged as a major production system in the irrigated areas of Haryana over the last two decades. Concerns are now being raised that the existing high level of rice-wheat productivity cannot be sustained. A study was undertaken in Karnal and Kaithal districts during 1999 to identify and prioritise production constraints that cause losses in the rice-wheat system. There exists a large yield gap in rice and wheat (Table 7).

Table 7 : Yield losses due to major constraints in rice and wheat (kg/ha)

Constraints	Rice (non basmati)	Basmati Rice	Wheat
Biotic	1133.13	913.02	783.45
Diseases	682.00	514.50	214.65
Insects and pests	265.50	243.52	187.55
Weeds	185.63	20.00	258.25
Others	--	133.00	123.00
Abiotic	456.84	443.00	655.00
Water regime	205.00	123.00	230.00
Soils	150.00	40.00	75.00
Others	101.84	280.00	350.00
Socio-economic	220.04	708.98	213.55
Total (all constraints)	**1810.00**	**2065.00**	**1652.00**

At the system level, annual losses due to major biotic, abiotic and socio-economic constraints are estimated at Rs. 23164 million, which is about 50 percent of the current value of output in the rice-wheat system (Figure 3). Among biotic factors, rice blast tops the list followed by leaf blight (non-Basmati rice), Phalaris minor (wheat), leaf folder (Basmati rice), and poor seed quality (wheat). Important abiotic constraints are late sowing (wheat) and problem of brackish water (wheat), zinc deficiency (wheat), water stress (non-Basmati rice) and low plant population (wheat), Socio-economic constraints are related to irregular and inadequate supply of inputs like power, water, agro-chemicals, seeds, labour and price risk

Figure 3: Distribution of value of output lost among constraint categories.



The results identify research and other strategies to address these problems. Integrated pest management and integrated plant nutrient management technologies will enable bridging these gaps at low cost and should receive high priority. On policy front, the most urgent need is to ensure regular power supply to the farm sector and encourage development of labour-saving devices suitable for rice-wheat farming. Similarly, policies towards fertiliser subsidy need to be restructured in favour of potassium and phosphoric fertilisers and use of biological

substitutes to the nitrogen fertilisers should be promoted. Input supply system should be strengthened to ensure timely supply of quality inputs.

Production Constraints in Dairying

B. C. Roy, K. K. Datta and Raka Saxena

Dairying is next to field crops in Haryana. Of late, growth in milk production has started decelerating. This study identifies and prioritises constraints in dairying. The yield gap II, in percent terms, is smallest in crossbred cattle, while it is maximum in case of indigenous cattle. The yield gap I is found highest in crossbred and lowest in buffalo. The total value loss due to technical constraints in dairy farming in Haryana amounted to Rs. 13746 million. This makes up more than 75 percent of yield gap II. A higher proportion of production loss is attributed to technical constraints. Mineral deficiency, FMD, mastitis, failure of artificial insemination and high rate of abortion are the problem areas in cattle and buffaloes, which need to be addressed through research.

Crop Diversification in Rainfed Agriculture

P.K. Joshi

Crop diversification is an important strategy for enhancing agricultural production and improving sustainability of natural resources in rainfed regions. This study explores opportunities and proposes appropriate strategies for crop diversification in a predominantly rainfed production system spanning 22 districts of the Vidharba, Central and Marathawada region of Maharashtra, northern Andhra Pradesh and Karnataka, and southern part of Madhya Pradesh.

Based on inter-regional characteristics, the production system was divided into four sub-regions: (i) rice sub-region, (ii) sorghum sub-region, (iii) sorghum/cotton sub-region, and (iv) a cotton/sorghum sub-region. Rainfed agriculture is highly diversified. Many new oilseed crops and few pulses were finding niches in the rainfed agriculture. Over the years, however, there was little change in diversity index. Diversification in rainfed agriculture is obviously expected for rotation purpose (e.g. pest control, soil-water-nutrient management) and for farm labor distribution purposes. This also minimises production risk, and improves sustainability of soil and water resources by preventing (or reducing) their long-run degradation. Cropping intensity in rainfed agriculture in different sub-regions was low in comparison to irrigated agriculture. The increase over a period of time was slow despite availability of new technologies.

Rainfall and pressure on land were the most important factors leading to crop intensification. Tractorisation and irrigation too exerted positive influence. To decrease fallow lands and increase cropping intensity, new crops (e.g., blackgram, greengram, soybean, and other oilseed crops), and improved cropping systems (e.g., sorghum, maize and soybean intercrop with pigeonpea), complemented by farmers' friendly crop and resource management technologies to conserve moisture and provision of drainage (e.g., watershed approach) may be popularised through aggressive extension programmes.

Chickpea in Non-Traditional Areas: Role of Technology and Policy

P.K. Joshi

Expansion of chickpea area in hot and dry climate has raised logical questions on sources of area expansion, and reasons thereof. This study is based on the information from Andhra Pradesh where area under chickpea increased substantially since 1990. Production of chickpea accelerated more than 16 percent annually during the last five years (Table 8). Interestingly, entire growth in production was driven by area. The area under chickpea during 1991-96 increased at an annual rate of about 20 percent, whereas the yield levels during this

period showed a declining trend. Area expansion has come from crop substitution and utilisation of fallow and marginal lands. It was noted that area under rabi sorghum and tobacco was declining. It was also observed that area under rabi fallow in selected districts was decreasing overtime; while chickpea area was expanding.

Table 8: Annual compound growth rates (%) of production, area and yield of chickpea, Andhra Pradesh

Period	Production	Area	Yield
1970-80	-2.31	-1.12	-1.21
1981-90	5.75	2.28	3.39
1991-96	16.05	19.88	-3.20

Results of a regression-based model indicated that in Anantpur district the variables that influenced chickpea area were chickpea yield, its prices, and rabi sorghum yield instability. On the other hand, the regression coefficients of rabi-sorghum yield, irrigated area and post-rainy season rainfall were negative and significant, indicating that any increase in these variables would result in decline in area of chickpea, ceteris par/bus. In Kurnool district, chickpea prices, rabi-sorghum yield and availability of improved chickpea varieties were showing positive response to chickpea area allocation. In Medak district, chickpea yield, its prices, irrigated area, post rainy season rainfall and availability of improved chickpea varieties were positively and significantly determining chickpea area. The negative regression coefficients of yield, yield risk and price of rabi-sorghum suggest that any increase in their magnitude would release chickpea area for other crops. This implies that policy support (in terms of favourable prices) and technological changes (in terms of improved high yielding and short duration varieties) are necessary conditions for chickpea area expansion in the regions experiencing hot and dry climate.

Analysis of Long-term Fertiliser Response

B.C. Barah

Intensive use of chemical fertiliser and its impact on crop production is a matter of concern. The long-term fertiliser trials are analysed using on-station experimental data for rice and wheat from 10 locations in different agro-ecosystems for the period 1985-95. The yield response to fertilisers has weakened in recent years as is suggested by the trend coefficients (Table 9). The declining trend is more severe in case of application of pure chemical fertilisers, compared to others. This implies deteriorating soil health due to continuous application of chemical fertilisers.

Table 9 : Trend coefficients of yield of paddy and wheat, 1985-95.

Treatment	Faizabad	Ludhiana	Pantnagar	Kalyani
Paddy				
NPK100%	-1.113	-1 .796	-0.756	-1.189
NPK+FYM	-0.054	-1.507	-0.710	-0.953
NPK+CR	-0.076	-1.113	-1.143	-0.567
NPK+GM	-0.796	-1.577	-0.931	-1.226
Wheat				
NPK100%	1.13	-0.52	-1.26	0.40
NPK+FYM	1.33	-0.16	-0.92	-0.24
NPK+CR	1.35	-0.26	-1.19	0.02
NPK+GM	1.37	-0.49	-1.12	0.40

N - nitrogen,
P - phosphorus,
K - potas,
FYM -farm yard manure,
GM - green manure, and
CR - crop residue.

Water and Fertiliser in Relation to Targeted Wheat Yield

K.S. Sandhu, V.K. Arora, Ramesh Chand, B.S. Sandhu and K.L. Khera

Data on long-term field experiments conducted at different sites in Punjab was used to estimate relation between grain yield and water supply and fertiliser nitrogen. A method based on the principle of equi-marginal productivity of water in different periods of crop growth has been used to estimate the optimum allocation of given amount of water over different crop growth periods. Substitution possibilities between water and nitrogen during various crop growth stages to attain same level of yield were also explored and analysed.

Yield isoquants have been derived for low, medium and high yields. These show that for medium yield range (4-5 tonne grain/ha) there is substitution possibility between water and fertiliser. The study also shows that with 53 cm/ha of water supply applied in optimal quantity in different growth stages with 120 kg N/ha, yield beyond 6 tonne per ha can be achieved.

Economic Feasibility and Impacts of Integrated Pest Management

Pratap S. Birthal, O.P. Sharma, Sant Kumar and A. Dhandapani

In view of increasing resistance of some deadly insects like Helicoverpa to the insecticides and rising costs of plant protection measures, Integrated Pest Management (IPM) is being suggested as an alternative to chemical pesticides. This study was undertaken to evaluate the economic performance and impacts of Integrated Pest Management in rainfed cotton in Nanded district of Maharashtra.

The findings of this study indicate that IPM has the potential to curtail pesticide consumption in cotton production without any adverse effect on crop productivity. It had positive impacts on beneficial insects, predators, parasites and pathogens and provided better control of insect pests such as Helicoverpa armigera and white fly, which are reported to have developed resistance to insecticides. As a result, yield saving potential of IPM was 24 percent higher than the existing farmers' pest control practices dominated by application of chemical pesticides. Economically, Integrated Pest Management proved to be a better alternative to predominantly pesticides dominated approach to pest control. The cost of production and cost of pest control per quintal of output was 19 and 21 percent lower on IPM farms, respectively, compared to non-IPM farms (Table 10). Of the total difference in yield between IPM and non-IPM farms, about 55 percent was on account of IPM.

Table 10: Indicators of economic performance and impacts of IPM in cotton, 1998-99

Indicator	Unit	Non-IPM	IPM
Pesticide use	Kg a.i./ha	3.16	0.014
Crop yield	Qtl/ha	8.80	10.90
Cost of production	Rs./qtl	911.69	740.26
Cost of plant protection	Rs./qtl	446.18	351.94
Human labour use			
Male	Days/ha	24.90	22.19
Female	Days/ha	81.22	110.91

IPM was identified as a labour-intensive method of pest control because of labour-intensive nature of some of its components (manual collection of insect larvae) and increased labour requirement in crop harvesting induced by higher yield. Gender differences in labour use were distinct. Female labour use overwhelmingly outweighed the male labour use. Activities like manual collection of insect larvae, weeding and harvesting were exclusively in the domain of females.

The results suggest that faster adoption of IPM practices is likely to demand reorganisation of plant protection programmes and evolution of grassroots level institutional arrangements. The success of IPM will depend on its ability to improve upon farmers' existing stock of knowledge of pests, pest control techniques, methods of application, etc.

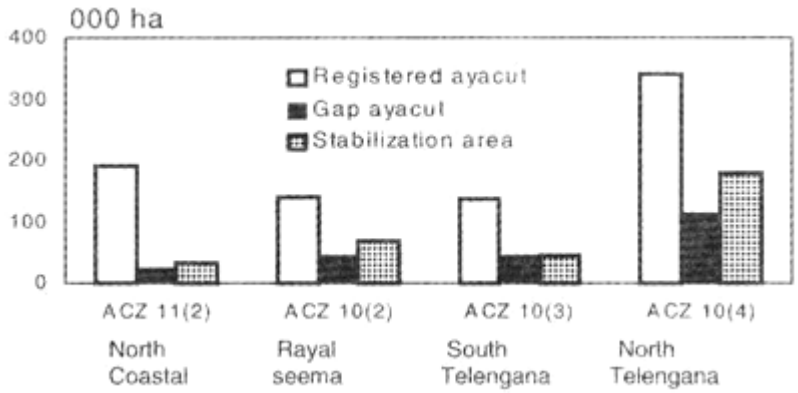
SUSTAINABLE AGRICULTURAL SYSTEMS

Deteriorating Status of Minor Irrigation Tanks in Andhra Pradesh

S. Selvarajan and P.A. Lakshmi Prasanna

Neglect of minor irrigation sector's maintenance has led to continuous deterioration in the performance of minor irrigation tanks. Tanks as a source of irrigation depressed overall annual growth in net irrigated area by about one-fourth in the state over the last three decades. Total number of minor irrigation sources in Andhra Pradesh is 12351 with a total ayacut of 12.52 lakh hectares spread across 23 districts of the state, which are grouped under six sub-zones under two agro-climatic zones. Based upon a random sample of 351 minor irrigation tanks from 16 districts falling under four sub-zones, the tank command area was classified into fully irrigated area, partially irrigated area (stabilisation area) and gap ayacut, which was then projected for the four sub-zones as a whole (Figure 4).

Figure 4: Deteriorating tank irrigation infrastructure in Andhra Pradesh, 1990s



The total gap ayacut area in all the four sub-zones is estimated to be 2.26 lakh hectares, which is about 5 percent of current net irrigated area from all the sources for the state. Another 3.30 lakh ha of area currently irrigated by minor irrigation tanks is the area that is partially irrigated during 1990s, which is about 8 percent of the current net irrigated area. Minor irrigation tanks located in North coastal sub-zone were able to continuously irrigate around 70 percent of the registered ayacut during 1990s. More than 80 percent of the gap ayacut and area for stabilization are located in the Rayalseema and Telangana regions.

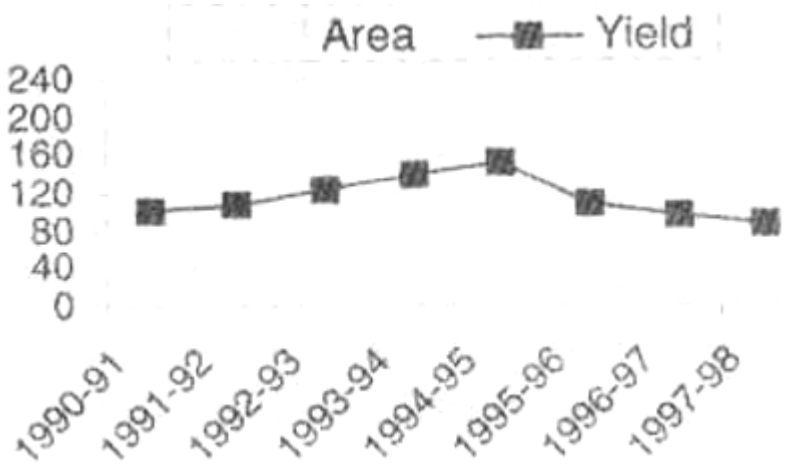
Of the total minor irrigation sources, 30 percent are located in eight drought prone districts viz. Prakasam, Chittoor, Cuddapah, Anantapur, Kurnool, Mahaboobnagar, Rangareddy and Nalgonda, which account for 26 percent of the ayacut area under minor irrigation sources in these districts. More than 80 percent of the mandals identified as greyanc dark categories are located in the Rayalseema and Telengana regions Furthermore, tank irrigation accounts for 29 percent of the net irrigated area. Fifty four percent of the net area irrigated by all tanks in the state is distributed between marginal and small farm holdings. This implies that improving the performance of the tanks will have favourable distribution impacts between regions as well as between various farm size groups within the region. There is a need for appropriate intervention to restore its potential functioning in meeting the multiple needs of the village society.

Sustainability of Brackishwater Aquaculture

M. Krishnan and Pratap S. Birthal

Brackishwater shrimp farming has been a thrust area for development since 1991 because of its high value and export potential. Till eighties it was largely a subsistence-oriented activity pursued by the fishermen with little or no use of external inputs. The yields, though low, were sustainable nevertheless. Induced by high profitability of shrimp farming coupled with favourable trade policies, the corporate sector entered this enterprise in a big way in early nineties. This led to the process of intensification of brackishwater aquaculture. In the pursuit of reaping rich dividends, the conditions of a sustainable production were relegated to the background. Use of illegally imported seeds, high stocking density, intensive use of feed, medicines, etc. along with inadequate effluent discharge and treatment mechanisms led to outbreak of diseases. This started threatening the Sustainability of the brackishwater aquaculture, apart from causing adverse effects on ecology and society. As a result, shrimp production that increased tremendously till 1994-95, started declining. The growth in production resulted both due to area expansion and yield improvements. After 1994-95, though the area kept increasing, production has been on a downward trend owing to faster decline in yield (Figure 5).

Figure 5: Trend in indices of area and yield of shrimp in India



Though, there is an ample potential to raise shrimp production in the country; hardly about 17 percent of the available brackishwater area has been developed for shrimp farming (Table 11). Extent of utilisation varies substantially across the states. Karnataka and Andhra Pradesh have brought maximum of the potential available area under shrimp culture (>44 percent). Orissa with 36 percent of the available brackishwater under aquaculture ranks second. In Kerala, about one-fifth of the available potential area has been utilised for shrimp production. West Bengal that accounts for maximum share in available brackishwater area has brought only 10 percent of it under aquaculture. Besides, the average yield is low and varies substantially across the states from 236 kg/ha in Gujarat to 1787 kg/ha in Tamil Nadu.

Table 11: Potential brackishwater area, area covered production and yield of shrimp in different states, 1997-98

State	Potential area (ha)	Area covered (ha)	Percent area utilised	Production (tonnes)	Yield (Kg/ha)
Andhra Pradesh	150000	66290 (46.82)	44.19	34075 (50.96)	514.03
Goa	18500	650 (0.46)	3.51	590 (0.88)	907.69
Gujarat	37600	997 (0.70)	2.65	235 (0.35)	235.71
Karnataka	8000	3540 (2.50)	44.25	2640 (3.95)	745.76
Kerala	65000	14595 (10.31)	22.45	7290 (10.90)	499.49
Maharashtra	80000	970 (0.69)	1.21	700 (1 .05)	721.65
Orissa	31600	11332 (8.00)	35.86	5000 (7.48)	441.23
Pondicherry	800	22 (0.02)	2.75	20 (0.03)	909.09
Tamil Nadu	56000	670 (0.470)	1.20	1197 (1.79)	1786.57
West Bengal	405000	42525 (30.03)	10.50	15121 (22.61)	355.58
Total	**852500**	**141591 (100.00)**	**16.61**	**66868 (100.00)**	**472.26**

Figures in parentheses are percent of total.

MARKETS AND TRADE

Trade Liberalisation and Indian Agriculture

Ramesh Chand

This study analyses potential impact of trade liberalisation on domestic wholesale and farm level prices of rice, maize and rapeseed-mustard. The impact is also studied on producers, consumers and net social welfare. Implementation of WTO agreement would have a mixed impact (Table 12). The country would be net gainer in some commodities and net looser in others. In case of paddy, trade liberalisation at existing trade prices increases net return merely by 2.6 percent but free trade with full Uruguay effect leads to 17.6 percent increase in the net return. When the latter scenario is combined with removal of subsidies, net income declines by 10.5 percent. It is found that the reduction in income due to removal of input subsidies in paddy production would not be compensated by the access to international prices. Trade liberalisation is found to be highly beneficial for maize. Net return over variable cost in the base scenario goes up by 63.6 percent with liberalisation. Further liberalisation of trade towards full Uruguay round raises the net return by 81 percent. The negative income effect of removing subsidies is more than offset by liberalisation. In case of rapeseed-mustard, liberalisation of oil imports would reduce the net return by one-fourth. Along with this if subsidies are removed, the net return declines by about 35 percent.

Table 12: Impact of trade liberalisation on selected agricultural commodities

Particulars	Liberalisation at existing international prices	Liberalisation with full WTO impact
Nominal protection coefficient		
Rice/paddy	0.988	0.923
Maize	0.852	0.819
Rapeseed/mustard	1.219	1.173
Change in wholesale price (%)		
Rice	1.39	9.38
Maize	20.84	26.46
Rapeseed/mustard oil	-17.94	-14.75
Change in farm level price (%)		
Paddy	1.45	9.81
Maize	21.46	27.25
Rapeseed/mustard seed	-15.79	-12.98
Net social welfare (Rs. million)		
Rice/paddy	-309	-437
Maize	3946	524
Rapeseed/mustard	563	356

As multi-lateral trade liberalisation takes place leading to rise in international prices, the adverse impact on net return would be reduced. In the selected crops, free trade is estimated to have sharp positive impact on net return from production of exportables like maize and rice, whereas it is going to have small negative impact on net return from the importables like

rapeseed-mustard. In rice, where level of input subsidy is high, free trade would not be sufficient to counter the adverse impact on income due to withdrawal of subsidies.

Trade in Exports of Livestock Products

Anjani Kumar and Harbir Singh

Till 1988, India was net importer of livestock products. The scenario changed during early nineties and livestock products' exports exceeded imports (Table 13). Among different livestock products, export of meat and meat preparations has performed better. Thus, to boost their export, various sanitary and phytosanitary measures should be taken up vigorously to ensure international hygienic standards. Despite impressive growth of export of dairy products and eggs, their export has remained most unstable. The export of leather goods is consistently increasing and the earnings there from can pay for the imports of raw hides and skins. This suggests, that given a favourable trade policy, there is sufficient potential to increase exports from livestock sector.

Table 13: Share of exports and imports (%) of livestock products in the exports and imports of agricultural and merchandise trade

Triennium	Exports		Imports	
	Total agricultural exports	Total merchandise exports	Total agricultural imports	Total merchandise imports
1974-76	0.88	0.30	3.72	0.98
1977-79	2.13	0.60	6.89	1.08
1980-82	3.50	1.02	14.27	1.41
1983-85	3.61	0.91	5.25	0.61
1986-88	3.42	0.66	5.48	0.51
1989-91	3.27	0.53	4.79	0.21
1992-94	3.93	0.54	2.98	0.17

Impact of Southeast Asian Economic Crisis on India's Livestock Sector

A. Ravishankar and Pratap S. Birthal

The study examines the extent to which India's livestock sector has been impacted by the crisis in Southeast Asian economies through trade. India has largely remained unaffected by the crisis. The growth in the economy has remained over 5 percent. The rupee has remained stable. The temporal fluctuations, if any, are beyond the crisis. The Southeast Asian region (Hongkong, Indonesia, North Korea, South Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand) roughly accounts for 15 percent of the India's exports (Table 14). Their share in India's exports to the region has increased consistently from 11.76 percent in 1991-92 to 16.63 percent in 1996-97. But, there was a slight decline in 1997-98.

The share of agricultural exports has been fluctuating year to year. In 1996-97, it was 21.16 percent, which declined to 15.71 percent in 1997-98. In case of livestock products, in 1997-98 these economies accounted for 48 percent of India's meat exports, 6 percent of dairy and poultry products and 4.8 percent of the leather goods. Compared to the previous year, there was only a marginal decline in the share of Southeast Asian region in India's exports. Since the crisis assumed severity in 1997, its true impact would be reflected in the years ahead.

Table 14: Trend in share of Southeast Asian countries in India's exports (%)

	Total exports	Agricultural exports	meat and meat preparations	Dairy and poultry products	Leather and Leather goods
1991-92	11.76	14.33	46.61	na	4.43
1992-93	12.76	12.87	37.48	na	5.37
1993-94	15.48	18.98	38.20	na	5.46
1994-95	15.10	16.23	50.91	9.22	5.68
1995-96	16.14	19.23	40.39	8.10	5.02
1996-97	16.63	21.16	49.87	2.99	5.4
1997-98	14.81	15.71	48.47	5.62	4.79

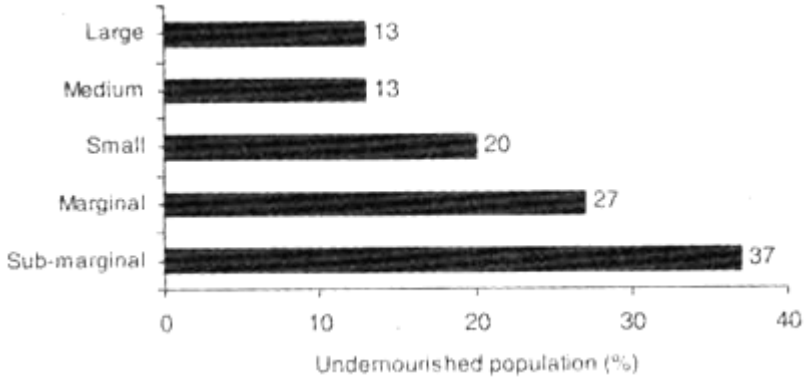
na not available

Factors Contributing to Nutritional Security of Farm Households

Praduman Kumar and P.K. Joshi

The study diagnoses the status of nutritional security and examines the influence of technological and socio-economic factors on nutrition intake using data from the 50th round of survey of the National Sample Survey Organisation. Assuming 2300 Kcal/caput/day cut-off point for undernourished population, nearly 29 percent of the rural farm-households were poor in 1993-94. This is the vulnerable group of rural farm households, who could not earn enough to support their minimum energy requirements. 1 ie most pitiable among all the categories was that of sub-marginal farm-households; about 37 percent of the them were living in penury (Figure 6).

Figure 6: Extent of undernourished population by farm size group



Nutritional security was studied in the context of four major cereal-based cropping systems viz. coarse cereals, rice, wheat, and rice-wheat based cropping systems. About 20 and 21 percent farm households were undernourished in the rice-wheat and wheat-based cropping systems, respectively. The corresponding farm-households in the rice and coarse cereals-based cropping systems were 35 and 41 percent. The most vulnerable categories were sub-marginal and marginal farm households in the coarse cereals-based cropping system. This

indicates that rice and wheat production technology has not only improved the calorie intake but also diversified food basket.

In the context of the relationship between irrigation and under nourishment, about one-quarter of the farm households were undernourished where there was no source of irrigation. With the availability of little irrigation water (only up to 20 percent), the number of undernourished farm-households dropped to about 23 percent. Further increase in the irrigated area, however, did not show substantial change in the calorie intake. It indicates that introduction of some irrigation helps meet the challenge of nutritional security. Dairying also has a crucial role in mitigating the severity of undernourishment.

Technology (particularly yield-enhancing rice and wheat), irrigation, and milch animals are the important elements for improving the nutritional security of the farm households. Targeting need-based research and technology dissemination for the coarse cereals-based system in southern and western regions, and rice-based system in the eastern and northeastern regions need special attention to address the problem of undernourishment. Livestock sector should also receive high priority with multiple objectives of diversifying agriculture, raising income and meeting the nutritional security of the poor farm households compared to food grain crops (Table 16). The net returns were also information on

Consumer Willingness to Pay for Seafood

M. Krishnan, Pratap S. Birthal and R. Venugopalan

This study explores the potential for development of domestic market for seafood. A survey was undertaken in prime residential localities of Chennai city to examine the seafood consumption habits, attitudes, perceptions and willingness to pay for different attributes of seafood (brand, variety, nutrition, quality and proximity to markets) over and above the current market price. Though seafood is a mixed bag, the survey confined itself to the predominantly shrimp.

The results support the hypothesis that shrimp consumption is confined to the elite class. A majority of the surveyed households had adequate knowledge of seafood attributes. Over half of the respondents had consumed seafood about 4 times a month. High price, non-availability of desired brand and variety, and lack of quality were some of the reasons for low consumption. Since the demand for seafood is price and income elastic, it comes out that decline in price of shrimp and increase in household income would lead to greater consumption of shrimp. The consumers were willing to pay 45 to 60 rupees/kg over and above the current market price of Rs. 200 per kg for its different attributes (Table 15). Thus, there is a latent demand for seafood that needs to be translated into effective demand through price and non-price mechanisms.

Table 15: Rank and willingness to pay for different attributes of shrimp

Attribute	% ranking attribute No.1	Average willingness to pay (Rs/kg.)	Maximum willingness to pay (Rs./kg)
Brand availability	12	28.25	50.00
Variety availability	39	26.46	45.00
Quality assurance	24	28.75	55.00
Nutrition value	24	40.54	60.00

Potential of Diversification towards High Value Crops

G. Singh and T. Hague

Crop diversification is considered desirable for income and employment enhancement. The study conducted in Uttar Pradesh revealed that per hectare labour use was nearly three times more in horticultural crops, considerably higher from horticultural crops.

Table 16: Labour use and net returns per hectare for different crops in Uttar Pradesh, 1997-98.

Crop	Labour use (Mandays)	Net returns (Rs)
Foodgrains		
Rice	112	8094
Wheat	96	7818
Maize	109	6689
Vegetables		
Potato	352	36146
Tomato	261	42679
Brinjal	227	17075
Onion	431	29813
Bhindi	293	24505
Cauliflower	351	36144
Fruits		
Guava	198	21296
Mango	24	57329
Apple	333	31236
Peach	393	32826
Lemon	431	20686
Flowers		
Bela	433	78430
Marigold	356	31147
Rose	364	70037
Gladiolus	190	26439

These benefits should normally encourage farmers to diversify in favour of such crops. However, a number of constraints prevent farmers from allocating more area to these crops. These include, lack of proper arrangements for transporting the produce and its marketing. Specialised nature of horticultural crops and lack of adequate knowledge on its cultivation is another set of constraints. Concerted efforts in improving the infrastructure for storage, marketing and transportation and strengthening extension efforts in horticultural crops would help bring more area under horticultural crops.

Information Flow in Commercial Seed Market

Suresh Pal and Robert Tripp

Indian seed industry has undergone significant changes since early eighties. The most important change has been the entry of private sector. With the presence of multiple seed agencies, availability of modern seeds has improved. But the concern remains regarding how effectively seed is delivered to the farmers. Studies conducted for commercial pearlmillet (Rajasthan) and rice (Andhra Pradesh) seed markets indicate that there is little flow of information to the farmers. 'Other farmer' continues to be the most important source of information on varieties and hybrids (Table 17). The situation was comparatively better in pearlmillet hybrid seed, where seed dealers also provided some information to the farmers. As a result, 35 to 76 percent farmers were able to identify name of the seed company. There are some proprietary hybrids in pearlmillet and private seed companies promote them to establish their brand image through seed dealers. This awareness was weak in case of rice seed and only 12 to 31 percent of the farmers were able to identify company name.

Table17: Sources of information on current varieties/hybrids

Seed market	Source of information on varieties/hybrids (%)			
	Other farmer	Extension agent	Seed dealer	Others
Rice varieties (Andhra Pradesh)				
Srikakulam	72	26	-	2
East Godavari	74	21	-	5
Mahboobnagar	86	6	-	8
Pearlmillet hybrids (Rajasthan)				
Shekhawati	48	12	36	4
Behror	39	15	46	0

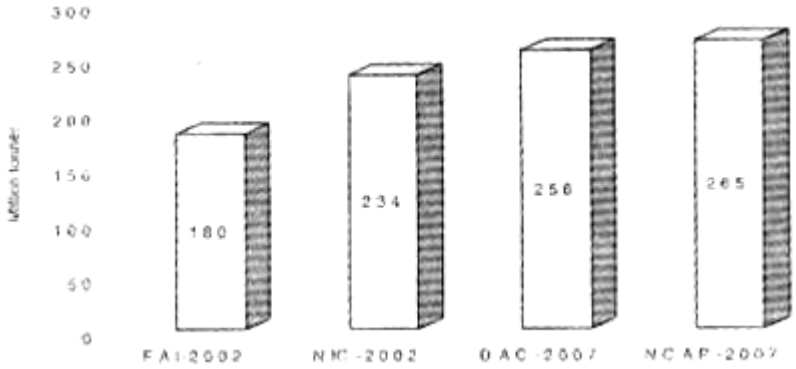
Multiplicity of actors in seed system may be good for competition, but it may confuse farmers, particularly when there are dozens of hybrids and varieties. The seed agencies, particularly the public sector, should strengthen the information system. Involvement of farmers in testing of promising material would be highly beneficial. Consumer education and prompt redressal of grievances are essential to make the seed system more responsive.

Demand for Fertilisers in the Xth Five Year Plan

A. Ravishankar and N. P. Singh

Applying ARIMA (Auto Regressive Integrated Moving Average) model, demand for fertilisers (NPK) is estimated at 265 million tonnes by 2006-2007. This estimate is higher than the one projected by the Working international companies, and private and public sector institutions. The Group for the Tenth Five Year Plan. Projections have been made for two scenarios viz. with and without price corrections. The estimates arrived at after internalising price corrections are modest and stand at 225 million tonnes by the terminal year of the Tenth Five Year Plan. The projections were made at three levels i.e., national, zonal and state. Offtake and consumption of fertilisers especially in the eastern zone is bound to take off as a result of government policies that will accelerate the use of fertilisers in the northeastern sates. Estimates generated by different agencies are depicted in Figure 7.

Figure 7: Demand projections of NPK by different agencies



While, the Fertiliser Association of India (FAI) and the National Informatics Centre (NIC) have made projections up to 2002, the DAC/ WG has forecasted for the Tenth Plan. There are apparent variations in the projected estimates of different agencies. The estimates of the present study are close to the DAC figures at least for nitrogen. For total nutrients, the estimates are neither as high as that of NIC nor as low as that of FAI. But, these are much lower than the DAC estimates.

INSTITUTIONAL CHANGE

Emerging Institutional Linkages in India's Seed Sector

S. Selvarajan

Evolving appropriate institutional-mix in the context of ongoing economic reforms is necessary for sustained agricultural growth. The desirable pathway for such developments is traced through several experimentation with institutions, technologies and policies that are continuously evolving. One such experimentation, identified in the Indian seed industry, is joint multiple ventures involving national and initiative started in late 1980s when Bejo Zadan, Holland evolved a complementary business-cum-social partnership with Bejo Sheetal, Jalna (Maharashtra). Both the older and younger generation from both the companies initially spent more than a year during 1986-87 in each other's family environment to understand the culture and to forge a social relationship. This social relationship is now completely institutionalised and integrated. The Bejo Zadan supported Bejo Sheetal with funding and sourcing of advanced technologies for seed development and providing access to global market for jointly produced seed. Bejo Sheetal provided cost effective R&D and seed multiplication, besides a limited access to the domestic market. Encouraged by the success, Bejo Sheetal and Bejo Zadan enlarged the domain by establishing linkages with Rallies, which initially traded domestic market accessibility for funding R&D by Bejo Sheetal and Bejo Zadan and this contract is renewed every three years. Encouraged by the success, Bejo Zadan and Bejo Sheetal have acquired equal partnership in Rallies Hybrid Seed Limited company to develop and produce new seeds that are not presently covered by them. Rallies also has developed collaborative research linkages with public sector institutions like Indian Institute of Science, Bangalore, and other agricultural and traditional universities.

The partnership and linkages carefully evolved and nurtured over years have helped identify complementary linkages and trade-offs. For example Holland weather which is most conducive to cabbage flowering is exploited by shifting the R&D software from India to Holland and similarly, south Italy, which has excellent weather to screen potato in February is exploited by shifting the R&D software from India to Italy. India's diversity in weather helps in effective screening of varieties and matching technology with weather in a cost effective manner for further multiplication and distribution.

While such new innovative institutional models are still in their early stages of development, their continuation and ultimate success must be based on mutual trust and successful results for all stakeholders.

Institutional Reforms for Rehabilitating Minor Irrigation Infrastructure

S. Selvarajan and P.A. Lakshmi Prasanna

Mounting revenue deficit in irrigation sector has jeopardised the physical sustainability of irrigation infrastructure. Several states have, therefore, initiated irrigation management reforms. Orissa, Tamil Nadu, Haryana and Andhra Pradesh are some of the states to have taken up the task of improving and decentralising the irrigation system management. The focus so far limited to major and medium irrigation projects, is now spreading to minor irrigation (surface) sector also.

Andhra Pradesh is one such state that has witnessed sharp deterioration in the minor irrigation infrastructure following the collapse of traditional institutions like kudimaramath that took care of maintenance of thousands of tanks for several centuries. As of today, all minor irrigation sources together (12351 in number) irrigate only 44 percent of the registered ayacut as against 82 percent in early 1950s. Analysis of the performance of 384 minor irrigation tanks for 1990-98 and projected for the state revealed that only 31 percent of the registered ayacut got regularly irrigated; 41 percent got partially irrigated and the remaining 28 percent was never irrigated. At constant prices, O&M allocation per hectare for the minor irrigation tanks remained not only abysmal, but also came down further by one-third during the period.

Andhra Pradesh Farmers' Management of Irrigation Systems Act, 1997 was enacted to give farmers statutory role in the management and maintenance of irrigation systems in the state. Following this, 8315 Water User Associations (WUAs) have been formed for minor irrigation sources. In the initial phase, 2980 minor irrigation tanks have been selected and the office bearers of these WUAs then conducted walk-through surveys along with the Minor Irrigation department personnel in the catchment area, tank storage system and ayacut area. In this process, the group identified the current deficiencies in the system and documented it. The Minor Irrigation department then prepared necessary estimates for undertaking the rehabilitation works.

The rehabilitation activities are designed to be implemented under the supervision and active participation of respective WUAs to their satisfaction to pave the way for ultimate take over of the operation and management responsibility by the WUAs. Currently, the government is providing Rs 250 per hectare of registered ayacut exclusively for O&M, which will be generated by the WUAs after the transfer of minor irrigation tank system to ensure both physical and financial sustainability of the system in future. The involvement of WUAs in planning, designing and implementing the rehabilitation strategies based on the specific needs as identified for each tank by WUAs also facilitates the scope for community participation in cost sharing of the proposed strategies by contributing labour for restoration activities like the clearance of jungle for free flow of water through the inlet channels.

Scope of Privatising Farm Extension

Rasheed Sulaiman, V and V. V. Sadamate

A study conducted in Bihar, Kerala, Maharashtra and Rajasthan showed that the participation of private sector in agricultural extension activities is limited to only few crops (especially horticultural crops) and select geographical regions (having high potential). Except farmers' associations, producer co-operatives and state departments of agriculture, all other organisations spent little (less than Rs.20/ha) on extension related activities and employ very less manpower (1 for more than 10,000 to 5 lakh cultivators) for extension related activities. State Department of Agriculture continues to be the most important source of information for the farmers, though their emphasis on delivering technologies in non-foodgrain crops is low. Only about 42 percent of the farmers are really satisfied with the present extension support available to them. The extent of satisfaction with the present extension support was found to be the most important factor discriminating the farmers who are willing to pay for extension services. A good number of farmers (about 50%) are willing to pay for quality extension services especially in the area of plant protection advice and training programmes. The demand for paid extension services is high among farmers growing nonfood crops (horticultural crops) and those having higher agricultural income per unit area.

Considerable scope exists for initiating paid extension services in India. Public sector extension could either commercialise some of its services, if it could initiate quality services, and/or set the environment for more active private sector participation in the provision of extension services. It should concentrate on educational programmes for farmers, facilitating formation of farmers' groups, building linkages with other technology providers and initiating paid consultancy services by maintaining a cadre of qualified staff at district and sub-district levels. The present concentration of subject matter specialists at these levels does not match these needs.

Institutional Rural Credit in India

B. C. Barah

The rural banking system is confronted with a number of issues involving loan recovery, financial sustainability, internationalisation of the financial market and privatisation of banking. Indian rural credit institutions responded to the demand of the liberalised reform to improve the outreach in the rural areas in both horizontal and vertical dimension. Yet, the efficiency of the rural credit system both in operational and the outreach aspects has not shown any significant improvement. The main reason is the conflict between economic efficiency of credit institution and social objectives. Besides, politically influenced loan write offs and poor loan recovery result in mounting overdues.

In order to accomplish the dual goal of treating credit as a social good as well as enhancing economic efficiency, the loss making banks need to be encouraged by proper rehabilitation programme, liberal funding and adequate human resource development activities. The government and the Reserve Bank of India provide adequate incentives to accomplish the societal objectives. Yet, more thinking is necessary in the line of increased stock of own resources through reduced cash reserve ratio, improvement in efficiency of the tertiary branches, improvement in the health of the sick rural banks, rationalisation of lending, refinance and interest rate policy, increasing emphasis on regional development and ; pointed target group accomplishment, increasing involvement of the informal institutions and self help groups for efficient utilisation of credit and widening the coverage of the poor in the credit network. In addition, certain important policy changes to improve the rural credit delivery system and economic efficiency are needed in terms of intensive banker-borrower interaction, effective co-ordination between lending and development agencies, speedy solution of the borrowers' problems, easy accessibility, adequacy and timeliness in the provision of credit, prompt relief to deserving borrowers, innovative schemes in high potential areas and awareness among the borrowers about the banking norms, procedures, etc.

AGRICULTURAL GROWTH AND ADJUSTMENT

Regional Disparities in Indian Agriculture

Ramesh Chand and Sonia Chauhan

Concerted efforts have been made during the decade of 1980s to spur agricultural growth in low productivity and stagnant regions. It is an important policy concern to find out whether such efforts have yielded dividend and reduced the gap between rich and poor states. Agricultural income per rural person during early 1980s exceeded Rs. 1500 in Haryana and Punjab, whereas, it was below Rs 700 in Bihar, Orissa, West Bengal, Kerala, Tamil Nadu and Himachal Pradesh (Table 18).

During the recent triennium ending with year 1996-97, agriculture income per rural person was below Rs. 400 in Bihar compared to Rs. 952 for the whole country, at 1980-81 prices. Orissa and Assam turned out to be second and third from the bottom. Punjab and Haryana maintained first and second rank respectively with per capita income of Rs. 2749 and 2103. These results reveal that there is tremendous variation in per hectare and per person agricultural income across states. Also, different states are found to be moving on disparate growth path. Contrary to the claims about potential of east India, agricultural growth in this region except West Bengal is showing signs of stagnation and deterioration. There is clear evidence that since 1980-81, regional divergence in agricultural productivity and income has grown and the gap between underdeveloped and developed states has continued to increase.

Tablet 18: Level and growth in Net State Domestic Product (NSDP) agriculture per rural person at 1980-81 prices

States	NSDP Ag/person Rs.		Growth rate(%)	
	Triennium ending 1982-83	Triennium ending 1996-97	1980/81 to 1990/91	1990/91 to 1996/97
Andhra Pradesh	866	962	0.60	1.60
Assam	734	643	-0.20	-1.90
Bihar	457	375	0.50	-5.20
Gujarat	1095	1103	-2.20	2.60
Haryana	1589	2103	2.30	0.50
Himachal Pradesh	671	758	1.60	-1.10
Jammu & Kashmir	838	850	-1.00	0.60
Kamataka	969	1211	0.80	2.80
Kerala	624	994	2.40	4.20
Madhya Pradesh	737	963	1.80	1.80
Maharashtra	917	1279	1.80	4.80
Orissa	665	539	-0.20	-3.10
Punjab	1902	2749	3.40	1.50
Rajasthan	795	1138	1.90	2.00
Tamil Nadu	582	860	2.20	1.50
Uttar Pradesh	776	852	0.80	0.10
West Bengal	604	1062	3.60	5.10
All India	797	952	0.99	1.44

Emerging Crisis in Punjab Agriculture: Severity and Some Options for Future

Ramesh Chand

This study examines the scope of agricultural diversification to address the problems confronting Punjab agriculture. It also discusses prospects of various diversification alternatives and analyses their implications on employment, income, natural resources and ecology.

Growth rate in NSDP agriculture in Punjab registered a sharp decline during 1990s, compared to the decade of 1980s. It is the first time since the onset of green revolution that growth rate of agricultural output in Punjab is lower than the all India level. When the current growth rate in agriculture income (NSDP) is netted out for population increase, to arrive at per capita income, the growth rate comes out to be less than 1 percent (Table 19). Similarly, the performance of total economy is also found to be deteriorating and below the national average. This is a depressing picture for the State.

Table 19: Growth rates in Net Domestic Product and per capita income in Punjab and India (percent /annum)

	1980-81 to 1989-90	1990-91 to 1995-96
Net state domestic product - Agriculture:		
Punjab	5.19	2.89
India	3.05	2.93
Net domestic product - Total		
Punjab	5.30	4.17
India	5.18	5.22
Per capita income:		
Punjab	3.43	2.28
India	3.04	3.39

The study suggests three pronged strategy of diversification to accelerate growth and to check degradation of natural resources particularly water depletion. One, diversification through items of' mass production and consumption; two, concentration on area specific enterprises of moderately high value; and three, limited diversification through non-conventional high value items of elite consumption.

The enterprises in the first category, whose production should be encouraged at small scale but throughout the state, include milk (dairying), pulses, and oilseeds. The second category should include moderately high value commodities like vegetables, potato, onion, cotton, basmati rice and sugarcane. These enterprises should be carefully earmarked for different agro-climatic sub-zones based on the comparative advantage, and, different activities should be encouraged in different areas to avoid production gluts and price crash. The third type of diversification strategy should focus on items like floriculture, exotic vegetables, mushroom and alike crops. Most of these commodities involve high use of capital and high risk and their marketing generally requires locating suitable buyers and some sort of contract with the buyers. These enterprises should be encouraged at the fields of select farmers, who possess the risk bearing ability and entrepreneurial ability to explore and locate the markets/buyers, and who can carefully schedule supplies to match the demand.

Dairying is the best choice for agricultural diversification in the state, on ecological as well as economic grounds. It has vast potential for growth in employment and income and for restoring soil health. Efficient and modern system of marketing and processing is required to give boost to dairy industry in the state.

Growth and Variability in Rice Production in Eastern India

Suresh Pal, Sushil Pandey and Abedullah

The study tests the hypothesis of positive association between growth and variability in agriculture. Temporal and spatial changes in growth rate and variability (measured as annual percentage deviation from trend) in rice production are examined. An impressive growth in yield and production of rice was noticed in all the eastern states, except Bihar, during the 1980s and early 1990s. However, increase in growth rate was significant in eastern Uttar Pradesh for yield, in West Bengal for yield and production and in Orissa and eastern Madhya Pradesh for production. Nevertheless, rice yield in eastern India is about half of that in the northern region.

The variability of yield and production of rice has registered significant decline in eastern parts of Uttar Pradesh and Madhya Pradesh, whereas it increased significantly in Bihar. The district-level analysis shows that about 5 percent of rice area in the region registered

significant acceleration in yield growth with significant decline in the variability. A significant decrease in yield variability with no change in the growth rate was noticed in 15 percent of the area. No change in yield variability was observed in 73 percent of the area, and 30 percent of this area showed increase in yield growth. These results, thus, indicate that growth and variability are not necessarily positively correlated. Once the farmers adjust to new technology, yield can increase at the same or even at lower degree of variability. This fact was supported by the results of regression analysis showing that fertiliser use, a proxy for high yielding varieties and associate management practices, has negative and significant effect on rice yield variability.

Emerging Trends in Agricultural Investments in India

Ramesh Chand

This study constructs a new and broad series on public investment in agriculture at country and the state level and analyses changes in composition of public investment during the last two decades. It explores the nature of relationship between public and private investments in agriculture and the determinants of private investment. The study also analyses the impact of private as well as public investments on agricultural growth and productivity and looks into regional divergence in agricultural investments.

The new series includes capital expenditure on all the relevant heads of agriculture infrastructure, whereas the commonly used CSO series mainly consists of investment in irrigation. State-wise private investment in agriculture during 1981/82 and 1991/92 is presented in Table 20.

Table 20: State-wise total and per hectare private fixed capital formation in agriculture

State	Total current prices		At constant prices	
	1981-82	1991-92	1981-82	1991-92
	Rs Lakh		Rs/ha. of NSA	
Andhra Pradesh	11039	28283	86	96
Assam	1245	1886	40	26
Bihar	3940	7889	43	38
Gujarat	9820	20050	87	78
Haryana	8207	16890	195	176
Himachal Pradesh	697	3610	104	229
Jammu & Kashmir	837	1265	100	63
Karnataka	9853	53452	81	184
Kerala	5373	15746	210	257
Madhya Pradesh	11155	71588	51	138
Maharashtra	16695	65916	78	138
Orissa	1613	3703	23	21
Punjab	12854	19804	262	173
Rajasthan	9895	49878	56	112
Tamil Nadu	8926	38202	133	245
Uttar Pradesh	26663	68484	132	145
West Bengal	3351	9445	52	65
Goa, Daman & Diu	na	613	na	163
Arunachal Pradesh	na	903	na	222
Manipur	na	660	na	173
Meghalaya	na	194	na	35
Mizoram	na	154	na	87
Nagaland	na	903	na	174
Sikkim	na	15	na	6
Tripura	na	103	na	14
India	144498	480138	89	126

na not available

As was the case with public investment reported by CSO, capital expenditure on all major heads of agriculture in real terms has been declining. All major states and some of the small states show declining trends in the resources spent for infrastructure for agriculture. Among major states, the rate of decline has been highest in Punjab followed by Bihar. At country level, the series declined annually by 3.36 percent over the chosen period.

At all India level, 9.22 percent of net domestic product from agriculture sector was invested for capital formation in agriculture during the first five years of 1980s. However, during the second half of 1980s resources spent for agricultural infrastructure development declined to 7.40 percent of NDP from agriculture and to 5 percent in 1990s. Union government' contribution to capital formation in agriculture constituted about 1.8 percent of NDP from agriculture during late 1970s. The contribution ha dwindled to 0.25 percent during the 1990s. Investment in major an medium irrigation projects continued as the dominant item of capital

outlay on agriculture. Investment in storage and warehousing was th second most important item of capital outlay with 25-29 percent share These two heads account for about two-third of the total capital outlay on agriculture by states and union government. The lack c complementarity between private and public investment stands 01 prominently (Table 21) and flow of institutional credit and term of trade for agriculture have turned out to be the strong determinants of private investments in agriculture. As private investment is found to be more effective than public investment in output growth, it would be prudent to encourage private investments through institutional credit support rather than relying mainly on public investment for inducing private investment and output growth. In particular, flow of institutional credit should be increased in low investment states like eastern states.

Table 21: Public and private capital formation in agriculture as per CSC and the broad series at 1980-81 prices

(Rs. Crore)

Year	Investment as per CSO			Capital expenditure on all broad heads of agriculture
	Total	Public	Private	
1980-81	4864	1892	2972	3765
1981-82	4741	1878	2863	3887
1982-83	4865	1857	3008	3503
1983-84	4406	1843	2563	3507
1984-85	4888	1822	3066	3523
1985-86	4641	1631	3010	3451
1986-87	4360	1550	2810	2934
1987-88	4782	1580	3202	2690
1988-89	4737	1485	3252	2431
1989-90	4791	1301	3490	2284
1990-91	5076	1315	3761	2644
1991-92	5212	1135	4077	2663
1992-93	5873	1179	4694	2239
1993-94	5574	1272	4302	2914
1994-95	6244	1438	4806	2959
1995-96	6927	1250	5677	2537

Technology and Changes in Land Holding Structure in Punjab

Ramesh Chand

There is considerable interest to know how the green revolution technology has affected land tenure and tenancy and consequently the social welfare, There was a sharp decline in the number of operational holding between 1971 and 1981, but there was a marginal increase in the subsequent decade in all the districts of Punjab. Accordingly, average Size Of Operational holdings increased from 2.95 hectare in 1971 to 4.10 hectare in 1981 and then came down to 3.79 hectare in 1991. The distribution of holdings according to size categories reveals that during the first decade succeeding adoption of green revolution technology 60 percent marginal and 25 percent small holdings vanished, whereas, the number of holdings at upper

tail showed modest increase. During the second decade of post green revolution period, marginal and smallholdings increased and large holdings slightly decreased. The reasons for this type of trend are: emergence of an active land market with the onset of green revolution technology; increase in non-farm employment in the initial years following green revolution, which prompted many sub-marginal farmers to either sell their land or lease it out and earn higher income in non-farm jobs compared to the farming and a positive relationship between farm size and productivity through mechanisation.

Over a period of time, product innovations resulted in development of smaller sized machines and capital assets that alongwith the emergence of rental market for farm machinery and implements eased the constraint in adoption of new technology on lower sized holdings. Also, the green revolution has had its full impact by 1980-81 and the change process initiated by it slowed down in subsequent period. Employment in non-farm rural occupations except public services slowed down, which reduced the pace of shift from farm to non-farm occupations. Another factor, which contributed to reversal in 1980s, is emergence of commercial dairying. Promotion of commercial dairying in the state has complimentary relationship with crop production and it improved viability of uneconomic smaller sized holdings.

III Education and Training

Education

The support provided by this Centre to the Post-Graduate teaching and research guidance programme of Indian Agricultural Research Institute, New Delhi is as follows.

Name of the Scientist	Courses offered	Students guided	Area of Research
S. Selvarajan		Two (Ph. D) (Continuing)	Irrigation investment planning
			Sustainable watershed development
Suresh Pal		Two (Ph.D.)	Investment in agriculture, Sustainable rice-wheat system

Special Lectures

Name	Title of the Lecture	Venue
A. Ravishankar	WTO and food security: the Indian perspective (25 May 1999)	National Institute of Agricultural Marketing, Jaipur
	Trade and environment: challenges and opportunities (26 May 1999)	National Institute of Agricultural Marketing, Jaipur
	Game theory and its application in agriculture (14 June 1999)	Department of Agricultural Economics, UAS, Bangalore
	Irrigation development in India: equity & efficiency issues (16 December 1999)	Water and Land Management Institute, (Government of Uttar Pradesh), Okhla
	IPRs in agriculture: an economist's perspectives (15 November 1999)	National Bureau of Plant Genetic Resources, New Delhi
B. C. Barah	A lesson from on-station long term fertiliser trials in relation to sustainable agricultural systems	Centre for Advanced Studies in Agricultural Economics, IARI, New Delhi
	Utilisation of panel data in economic analysis	IASRI New Delhi
B. C. Roy	Prioritising production constraints in rice-wheat and dairy systems in Haryana (1-3 November 1999)	Centre for Advanced Studies in Agricultural Economics, IARI, New Delhi
B.C. Roy	Prioritising production constraints: methodological issues (11 November and 1 December 1999)	Centre for Advanced Studies in Agricultural Economics, IARI, New Delhi

Name	Title of the Lecture	Venue
P.K. Joshi	Impact assessment and research prioritisation (9 and 12 April 1999)	Centre for Advanced Studies in Agricultural Economics, IARI, New Delhi
	Prioritisation of research programs and projects: methodological issues in the NATP framework (1 June 1999)	Central Research Institute for Dryland Agriculture, Hyderabad
	Prioritisation of research programs (1 July 1999) Research prioritisation and impact assessment (27-30 July 1999)	Central Arid Zone Research Institute, Jodhpur National
	Theory of firm and welfare economics (7-10 September 1999)	Academy of Agricultural Research Management, Hyderabad
	Impact assessment and sustainability of Indian agriculture (19 January 2000)	Indian Agricultural Statistics Research Institute, New Delhi Gokhale Institute of Economics and Politics, Pune
Ramesh Chand	Profit function: theory and applications (24 August 1999)	IASRI, New Delhi
	Theory of consumer behaviour (10 September 1999)	IASRI, New Delhi
Rasheed Sulaiman	Participatory irrigation management (16 December 1999)	Water and Land Management Institute (Government of Uttar Pradesh), Okhla
S. Selvarajan	Modelling of irrigation system for impact analysis (15-16 December 1999)	Water and Land Management Institute (Government of Uttar Pradesh), Okhla.
	Minimum rehabilitation of minor irrigation infrastructure (26 October 1999)	Irrigation Department, Government of Andhra Pradesh, Hyderabad
Suresh Pal	Agricultural research prioritisation	Academy of Agricultural Research and Education Management, CCS HAD, Hisar

Guest Lectures

Eminent scholars from India and abroad gave seminars on the following topics.

Name of the visitor	Title of the Lecture	Venue
A. W. Van den Ban	Changing farming systems to realise new opportunities in the market	NCAP, New Delhi
N. S. Jodha	Globalisation of agriculture (29 September 1999)	NCAP, New Delhi
Nelson Perera	Data analysis and software for social sciences (15 March 2000)	NCAP, New Delhi
Nelson Perera	Cointegration and time series analysis (16 March 2000)	NCAP, New Delhi
Mahbub Hossain	Hybrid rice technology for India (25 March 2000)	NCAP, New Delhi
Peter Hezzel	A proposal for rainfed insurance (17 April 1999)	NCAP, New Delhi
A. Satheesh	Price risk and supply response (28 January, 2000)	NCAP, New Delhi
S. Mohanty	The future of Indian grain demand and supply (17 July 1999)	NCAP, New Delhi
Suresh Babu	Nutritional security (21 January 1999)	NCAP, New Delhi

Training Scientific

Name of the official	Theme	Duration	Place of training
Amit Kar	Quantitative techniques in agriculture	22.11.99 to 02.12.99	Indian Agricultural Statistics Research Institute, New Delhi
Anjani Kumar	Agricultural research prioritisation	01.02.99 to 06.02.99	National Centre for Agricultural Economics and Policy Research, New Delhi
	Relational database management system & access 97	02.08.99 to 07.08.99	Indian Agricultural Statistics Research Institute, New Delhi
	Measurement of technological change In agriculture	11.11.99 to 02.12.99	Indian Agriculture Research Institute, New Delhi
B. C. Roy	Agricultural research prioritisation	01.02.99 to 06.02.99	National Centre for Agricultural Economics and Policy Research, New Delhi
	Relational database management system & access 97	02.08.99 to 07.08.99	Indian Agricultural Statistics Research Institute, New Delhi
	Measurement of technological change in agriculture	11.11.99 to 01.12.99	Indian Agriculture Research Institute, New Delhi
M.B. Dastagiri	Computer training on MS Office 97& SPSS	29.11.99 to 10.12.99	Indian Agricultural Statistics Research Institute, New Delhi
P. Adhiguru	Web program and internet technologies	25.11.99 to 06.12.99	Indian Agricultural Statistics Research Institute, New Delhi
P.A. L Prasanna	Quantitative methods in agricultural economics	24.8.99 to 02.9.99	Indian Agricultural Statistics Research Institute, New Delhi
Rajni Jain	Visual Basic 6	30.11.99 to 17.12.99	NUT Ltd,, New Delhi
	Java application developer & Web application developer	07.01 .2000 to 06.03.2000	SQL International Ltd., New Delhi
Sant Kumar	Agricultural research prioritisation	01 .02.99 to 06.02.99	National Centre for Agricultural Economics and Policy Research, New Delhi
	Measurement of technological change in agriculture	11.11.99 to 01.12.99	Indian Agricultural Research Institute, New Delhi

Administrative

Name of the official	Theme	Duration	Place of training
M.S. Vashisht	New dimensions to reservations in service for SC/STs	0.3.06.99 to 0.5.06.99	Scope Complex, Lodhi Road, New Delhi
Narender Kumar	Labour laws with special reference to contractual labour in changed environment Effective office and administration management	09. 06. 99 to 11.06.99 04.08.99 to 0.8.08.99	Centre for Resource Planning and Action, New Delhi National Productivity Council, Udaipur
Naresh Kumar	Effective office and administration management	0.4.08.99 to 0.8.08.99	National Productivity Council, Udaipur
Umeeta Ahuja	Professional development for secretaries and personal assistants	09.07.99	Hotel Le Meridian, New Delhi

Technical

Name of the official	Theme	Duration	Place of training
Arun Kumar	MS Office	16.08.99 to 21 .08.99	Indian Agricultural Statistics Research Institute, New Delhi
M.S. Chauhan	MS Office 97 and SPSS	20.09.99 to 25.09.99	Indian Agricultural Statistics Research Institute, New Delhi
Sonia Chauhan	MS Office 97 and SPSS	20.09.99 to 25.09.99	Indian Agricultural Statistics Research Institute, New Delhi

IV Awards and Recognitions

Dr. Dayanatha Jha was elected as President of the Indian Society of Agricultural Economics for the year 2000. He was also elected as Editor of the Agricultural Economics Research Association (India).

Dr. P.K. Joshi was re-elected as member of the Editorial Board of the Indian Journal of Agricultural Economics. He was also elected as Secretary of the Agricultural Economics Research Association (India). Dr. Joshi was nominated as a member of the Publication Committee of the International Conference on 'Sustainability of Natural Resources in the 21st Century'. He also acted as Advisor of the Group on 'Environment and Policy' under the World Bank aided projects with the Indira Gandhi Research and Development Institute.

Dr. P.S. Birthal was elected as a Member of the Executive Committee of the Indian Society of Agricultural Economics.

Dr. B C Barah was elected to chair a mini workshop on 'Subsidy and Sustainability' at the international seminar on Agricultural Credit organised by the Asian Productivity Organisation, Tokyo.

V Linkages and Collaboration in India and Abroad including Externally Funded Projects

Visits Abroad

Name of the official	Purpose	Place	Duration	Outcome
A. Ravishankar	To participate in the workshop on 'Implication of Asian Crisis on Livestock Industry'	Bangkok, Thailand	05.07.99 to 10.07.99	Presented country report on livestock
Anjani Kumar	To participate in the international workshop on 'Understanding and Characterising Rainfed Rice Lowland Ecosystem'	Ball, Indonesia	05.12.99 to 09.12.99	Presented a paper 'constraints to adoption of modem varieties of rice in Bihar, eastern India
B. C. Barah	To participate in the international seminar on 'Agricultural Credit'	Tokyo, Japan	08.09.99 to 14.09.99	Presented a paper
P. K. Joshi	To attend the workshop on 'Curriculum Design for Sustainable Agriculture Training Program'	Economic Development Institute, World Ban Cote de Ivory	30.04.99 to 09.05.99	Gave lectures at various research institutes and SAUs
	To attend workshop on 'Sustainable Agriculture in West Bengal and Bangladesh	Economic Development Institute, World Ban Bangladesh	21 .06.99 to 23.06.99	Information used to further strengthen the on-going project
	To attend international workshop on 'Characterising and Under standing the Lowland Rice Systems'	International Rice Research Institute, Ball, Indonesia	04.12.99 to 10.12.99	Planning to develop a research proposal for NATP
Ramesh Chand	To attend draft report meeting of the 2nd term of the project 'Effect of Trade Liberalisation on Agriculture'	Bogor, Indonesia	13.04.99 to 15.04.99	Presented study results
	To attend regional workshop of the project 'Effect of Trade Liberalisation on Agriculture'	Bogor, Indonesia	05.10.99 to 08.10.99	Presented study reports of 1 st and 2nd term of study

Name of the official	Purpose	Place	Duration	Outcome
Ramesh Chand	To attend planning meeting of the proposed project on 'Investigating Issues and Options for Improving Livelihood of Marginal Mountain Farmers'	Kathmandu, Nepal	11.10.99 to 13.10.99	Presented a paper on Himachal Pradesh and helped in project formulation
	To present paper in the international seminar on 'Growth, Sustainability, Resource Management in the Mountain Areas of South Asia'	Kathmandu, Nepal	31.01.2000 to 04.02..2000	Presented a paper on development of India's mountain region
S. Selvarajan	To lead the Indian Mission to formulate sub-tropical area development programme for Bhutan	Bhutan	10.03.99 to 04.04.99	Proposal is submitted to the Ministry of External Affairs, Government of India
Suresh Pal	Visiting Scientist	IRRI, Philippines	10.05.99 to 30.0799	Research on growth and variability in rice production in eastern India

VI list of Publications

NCAP Publications

Policy Papers

Policy Paper 10 : Privatising Agricultural Extension in India

Policy Paper 11 : Emerging Trends and Regional Variations in Agricultural Investments and their Implications for Growth and Equity

Policy Briefs

Policy Brief 8 : Are Regional Disparities in Indian Agriculture Growing? Policy Brief 9 : Agricultural Extension in India-The Next Step

Policy Brief 10 : IPRs and Agricultural Technology: Interplay and Implications for India

Policy Brief 11 : Plant Variety Protection: Lessons from a Cross-Country Perspective

Policy Brief 12 : Improving Competitive Agricultural Research Funding in India

Workshop Proceedings

Proceedings 6 : New Paradigms of Agricultural Research Management

Proceedings 7 : Aquaculture Development in India: Problems and Prospects

Publications by Scientists

Research Papers

Adhiguru, P., V. Alagesan and G. Perumal (1999), "Involvement of farm women in farm and home activities- a review", Journal of Extension Education, 10(3).

Chand, Ramesh (1999), "Emerging crisis in Punjab agriculture: severity and options for future", Economic and Political Weekly, 34 (13).

Chand, Ramesh (1999), 'Trade liberalisation and net social welfare: a study of selected crops", Economic and Political Weekly, 34(52).

Chand, Ramesh (1999), Effects of trade liberalisation on agriculture in India: commodity aspects, Working Paper 45, CGPRT Centre, ESCAP, United Nations, Bogor, Indonesia.

Hansra, B.S. and P. Adhiguru (1998), "Agriculture transfer of technology approaches since independence in India", Journal of Extension Education, 9(4).

Joshi, P.K., M. Asokan, and M.C.S. Bantilan (1999), "Silent chickpea revolution in non-traditional areas: some evidences from Andhra Pradesh", Indian Journal of Agricultural Economics, 54(4).

Krishnan, M., P.S.Birthal and R. Venugopalan (1999), "Consumer willingness to pay for seafood, and domestic market development", Indian Journal of Agricultural Economics, 54(4).

Krishnan, M., P.S. Birthal, T. Ravisankar, K. Ponnusamy, M. Kumaran and Harbir Singh (1999), "HACCP Guidelines and economics of seafood processing -an impact analysis", Indian Journal of Agricultural Marketing, 13(2).

Kumar, Anjani (1998), "Milk production function and factor demand in milk production", The Bihar Journal of Agricultural Marketing, 6 (4).

Kumar, Anjani and J.N.Gupta (1999), "Role of women in dairying in middle-gangetic plain region of Bihar", Indian Journal of Labour Economics, 41(4).

Kumar, Anjani, J.N.Gupta, A.K.Jha and N.P.Singh (1999), "Contributions of women in dairy enterprise with special reference to middle-gangetic plain region of Bihar", Indian Journal of Agricultural Economics, 54(3).

Kumar, Sant (1999), "Women participation in IPM technology- the case of cotton production" Indian Journal of Agricultural Economics, 54 (3).

Pandey R.K. and Sant Kumar (1999), "Economic analysis of demand patterns for perishable products", Indian Journal of Agricultural Marketing, 13(2).

Rasheed Sulaiman V and Dayanatha Jha (1999), "Determinants of demand for paid farm extension services- a discriminant function approach", Indian Journal of Agricultural Economics, 54 (3).

Ravishankar A. and Sunil Archak (1999), "Searching for policy options: is CoFaB a suitable alternative to UPOV?", Economic and Political Weekly, 34(52).

Ravishankar, A. and Sunil Archak (1999), "Conservation and sustainable use of plant genetic resources in India: a review of policy issues and perspectives", Outlook on Agriculture, 28(2).

Sandhu, K.S., V.K. Arora, Ramesh Chand, B.S. Sandhu and K.L. Khera (1999), "Optimising time distribution of water supply and fertiliser nitrogen rates in relation to targeted wheat yields", Experimental Agriculture, 36(1).

Singh, Harbir (1999), "Intellectual property rights: socio-economic and ecological consequences for Indian agriculture", Indian Journal of Agricultural Economics, 54 (3).

Tripp, Robert and Suresh Pal (2000), "Information and agricultural input markets: pearl millet seed in Rajasthan", Journal of International Development, 12.

Popular Articles/Leaflets

Kumar, Anjani and Harbir Singh (1999), "Trade in livestock products in India: an overview", Yojana, 43 (10).

Ravishankar, A. and N.P. Singh (1999), "Budget' 99 and agriculture: continuity and hope", The Economic Times, March 19.

Ravishankar, A. and N.P. Singh (1999), "Budget' 99 and Agriculture", Financing Agriculture, 31 (1).

Ravishankar, A. and Parmatma Singh (1999), "Intellectual property rights in Indian agriculture: implications for small holders", Young Indian, 10(6).

Books

Selvarajan, S., Dinesh, C. Joshi and John C.O. Toole (1999), Agro-Biotechnology Capacity and Demand: The Indian Private Sector Seed Industry, Island Publishing House Inc. Manila.

Book Chapters /Reviews/Reports

Adhiguru, P. and B.S. Hansra (1999), "Networking agricultural system for effective linkage", In B.S. Hansra, K. Chandrakandan, V. Veerabhadraiah and G. Selvaraj (eds.) Globalizing Indian agriculture policies and strategies, Classical Publishing Company, New Delhi.

Birthal, P.S. and M. Krishnan (2000), " Aquaculture in India: overview and synthesis", In M. Krishnan and P.S. Birthal (eds.), Aquaculture development in India: problems and prospects, NCAP, New Delhi.

Birthal, P.S., O.P. Sharma, Sant Kumar and A. Dhandapani (1999), Economic evaluation of integrated pest management in cotton, NCAP-NCIPM Report.

Birthal, P.S., S.N. Arya, Yash Pal and M.P. Yadav (1999), Socio-economic issues in equine husbandry : a study in Haryana and Delhi, Technical Paper NRCE-NCAP-IASRI.

Chand, Ramesh (1999), Effects of trade liberalisation on agriculture in India: commodity aspects, Working Paper 45, CGPRT Centre, ESCAP, United Nations, Bogor, Indonesia.

Krishnan, M. and P.S. Birthal (2000), Aquaculture development in India: problems and prospects, Workshop Proceedings 7, NCAP-CIBA.

Krishnan, M., P.S. Birthal, K. Ponnusamy, M. Kumaran and Harbir Singh (2000), "Aquaculture in India: retrospect and prospects", In M. Krishnan and P. S. Birthal (eds.), Aquaculture development in India: problems and prospects, Workshop Proceedings, NCAP, New Delhi.

Kumar, Anjani, Dayanatha Jha and U. K. Pandey (1999), "Growth and productivity of livestock sector in India" in the proceedings of workshop on Measurement of productivity in India organised by Institute for Human Development and Department of Statistics, Government of India, New Delhi, July 9-10.

Mruthyunjaya, P.S. Birthal and L.M. Pandey (2000), "Systems approach to animal farming", In R. Nagercenkar and R.R. Lokeshwar (eds.) Animal farming systems in India, forthcoming.

Ravishankar, A. and Dayakar Rao (1999), "Sorghum production and consumption in Karnataka: shifts, trends and policy issues", In M. V. Srinivasa Gowda and T.Nanje Gowda(eds.) Economic development of Karnataka: leading issues, I EC, Bangalore.

Ravishankar, A. and P. S. Birthal (1999), 'The livestock sector in India: a country report with a special emphasis on trade with Southeast Asian economies", In FAO Implications of the Asian economic crisis for the livestock industry, FAO, Bangkok, duly 6-9.

Selvarajan, S. (1999), "Policy reforms and India's seed development and support system: emerging institutional linkages", In Ramesh Chand and V.P.S. Arora, Agricultural inputs and output market reforms in India, Agricultural Economics Research Association (India), New Delhi.

Selvarajan, S. and P.K. Joshi (2000), "Socio-economic policies and implications for sustainable soil and water resource management", in the proceedings of the international conference on Managing natural resources for sustainable agricultural production in the 21st century, New Delhi.

Presentations in conferences and symposia

Adhiguru.P. (1999), "Farmer-led participatory extension- an Indonesian experience and lessons for India", presented in the workshop on Farmer-led participatory extension organized by the International Extension Forum at Punjab Agricultural University, PAU, Ludhiana, November 27-28.

Barah, B.C. (1999), "Analysis of the components of income variability in the rainfed areas of eastern India", presented in the seminar on Risk analysis in rice production system, organised by IRRI/NCAP at New Delhi, September 22-24.

Barah, B.C. (1999), "Institutional rural credit in India", presented in the Productivity Organisation at Tokyo, September 8-14.

Birthal, P.S., O.P. Sharma, Sant Kumar and A. Dhandapani (2000), "Economic evaluation of integrated pest management in cotton", presented in the workshop on Impact of agricultural research in India, organised by the National Centre for Agricultural Economics and Policy Research at ICRISAT, February 10-11.

Chand Ramesh (1999), "Effect of trade liberalisation on agriculture: commodity aspects", presented in the project workshop, CGPRT, Centre, ESCAP, United Nations, Bogor, Indonesia, October 5-8.

Chand, Ramesh (1999), "Agriculture sector reforms for growth and equity", presented in the conference National competitive policy, National Productivity Council, April 5-6.

Chand Ramesh (1999), "Diversification of agricultural activities on marginal farms", lessons from Himachal Pradesh", presented in the planning meeting, ICIMOD, Kathmadu, October 11-14.

Chand, Ramesh (2000), "Agricultural development, growth, and poverty in India's mountain regions", presented in the conference on Growth, poverty alleviation and sustainable resource management in mountain areas of South Asia, ICIMOD, Kathmadu, January 31-February 4.

Chand, Ramesh (2000), "Socio-economic factors in agricultural diversification", presented in the symposium on Diversification of agriculture for human nutrition, sponsored by the National Academy of Agricultural Sciences at the National Institute of Nutrition, Hyderabad, December 16-17.

Dastagiri, M. B. (1999), "Indian agriculture: glorious past and promising future" presented in the conference Constraints and opportunities for agricultural and rural development in different agro-ecological regions, organised by the Agricultural Economics Research Association (India) at University of Agricultural Sciences, Dharwad, October 6-7.

Jha, A.K., Anjani Kumar and N.P. Singh (1999), "Prioritisation of constraints in soybean-based production system under rainfed agro-ecoregion" presented in the conference on Constraints and opportunities for agricultural and rural development in different agro-ecological regions, organised by the Agricultural Economics Research Association (India) at University of Agricultural Sciences, Dharwad, October 6-7.

international seminar on Agricultural credit, organised by the Asian Jha, A.K., Anjani Kumar and N.P. Singh (1999), "Prioritsation of constraints in soybean based production system under rainfed agro-ecoregion" presented in the conference on Constraints and opportunities for agricultural and rural development in different agro-ecological regions, organised by the Agricultural Economics Research Association (India) at University of Agricultural Sciences, Dharwad, October 6-7.

Joshi, P.K. (1999), "Crop diversification in rainfed agriculture", presented in the conference on Constraints and opportunities for agricultural and rural development in different agro-ecological regions, organised by the Agricultural Economics Research Association (India) at University of Agricultural Sciences, Dharwad, October 6-7.

Joshi, P.K. (1999), "Measuring impact of social science research in agriculture", presented in the symposium on Measuring impact of social science research, organized by the Agricultural Economics Research Association at the University of Agricultural Sciences, Dharwad, October 6-7.

Joshi, P.K. and Suresh Pal (1999), "Role of characterisation in ex ante assessment of agricultural technologies", presented in the international workshop on Characterizing and understanding rainfed environments, organized by Rainfed Lowland Rice Research Consortium (RLRRC) and International Rice Research Institute at Ball, Indonesia. December 5-9.

Kar, Amit (2000), "Subsidies in agriculture: its impact and alternative", presented in the national symposium on Social transformation in rural sector, Institute of Agriculture, Viswa-Bharati, Shantiniketan, February 1-3.

Kumar, Anjani and A.K.Jha (1999), "Constraints to adoption of modern varieties of rice in Bihar, eastern India", presented in the international workshop on Characterizing and understanding rainfed environments, rganized by Rainfed Lowland Rice Research Consortium (RLRRC) and International Rice Research Institute at Bali, Indonesia. December 5-9.

Kumar, Anjani, Dayanatha Jha and U.K.Pandey (1999), "Growth and productivity of livestock sector in India" presented in the workshop Measurement of productivity in India, organised by the Institute for Human Development, at New Delhi, July 9-10.

Kumar, P. and P.K. Joshi (1999), "Socioeconomic factors contributing to nutritional status of farm households in rural India", presented in the symposium on Diversification of agriculture for human nutrition, sponsored by the National Academy of Agricultural Sciences at the National Institute of Nutrition, Hyderabad, December 16-17.

Kumar, Sant (1999), "IPM- an opportunity to pest protection in cotton", presented in the conference on Constraints and opportunities for agricultural and rural development in different agro-ecological regions, organised by the Agricultural Economics Research Association (India) at University of Agricultural Sciences, Dharwad, October 6-7.

Ravishankar, A. (1999), "IPRs in agriculture: an economist's perspective", presented in the workshop on Plant genetic resources management policy and emerging IPR issues, held at National Bureau of Plant Genetic Resources, New Delhi, October 1.

Ravishankar, A. (1999), "The potential and scope for futures trading in essential oils in India", presented in the annual conference of the Essential Oils Association of India, held at Shimla, October, 14.

Ravishankar, A. and P.S. Birthal (1999), 'The Livestock sector in India: a country report with a special emphasis on trade with Southeast Asian economies", presented in the workshop on Implications of the Asian economic crisis for the livestock industry, FAO, Bangkok, July 6-9.

Roy, B. C and K. K. Datta (1999), "Prioritizing production constraints in rice-wheat system: a study in Indo-Gangetic plains of Haryana" presented in the conference on Constraints and opportunities for agricultural and rural development in different agro-ecological regions, organised by the Agricultural Economics Research Association (India) at University of Agricultural Sciences, Dharwad, October 6-7.

Saxena, Raka, B.C. Roy, N.P. Singh and K.K. Datta (1999), "Prioritizing production constraints of dairying in Haryana" presented in the conference on Constraints and opportunities for agricultural and rural development in different agro-ecological regions, organised by the Agricultural Economics Research Association (India) at University of Agricultural Sciences, Dharwad, October 6-7.

Selvarajan, S. (1999), '"Validation of rainfed agricultural typology", presented in the planning workshop on Increasing livestock productivity in mixed crop-livestock systems in South Asia, at ICRISAT, Patancheru, Andhra Pradesh, November 15-17.

Selvarajan, S. (1999), "Minimum rehabilitation of minor irrigation infrastructure" presented in the seminar on Minimum rehabilitation of minor irrigation schemes in Andhra Pradesh organized by the Irrigation Department, Government of Andhra Pradesh at Hyderabad, October 26.

Suresh Pal, A. Kumar and A. Singh (2000), "Plan allocations and agricultural research intensity in India", presented in the workshop on Impact of agricultural research in India, organised by the National Centre for Agricultural Economics and Policy Research at ICRISAT, February 10-11.

VII List of Approved On-going Projects

Title of Project	Project Leader	Year of start	Likely year of termination
Economic potential of biological substitutes for agro-chemical	P.S. Birthal	1997	2000
Development of small ruminant sector in India	P.S. Birthal	1997	2000
An Economic evaluation of brackishwater aqua cultural systems in India	M. Krishnan	1998	2001
Interaction and impact of technology infrastructure and Policy variables on agricultural development	T. Haque	1995	2000
Emerging trend and regional variations in agricultural investments and their implications for growth and equity	Ramesh Chand	1997	1999
Analysis of productivity changes and future sources of growth for sustainable rice-wheat production in indo-Gangetic regions	P.K. Joshi	1997	2000
Socio-economic dynamics of rice production systems in India	B.C. Barah	1999	2002
Equity driven trade, marketing policies and strategies for improved performance of Indian agriculture	Dayanatha Jha	1999	2000
The demand-supply projection of livestock products towards 2020 for India and their policy implication	MB. Dastagiri	1999	2000
Scope for privatising farm extension in India	Rasheed Sulaiman, V	1996	1999
Agro-climatic regional resource management for sustainable agricultural development	S. Selvarajan	1996	1999
Economic analysis of irrigation water use planning under uncertainty : a multi stage optimisation modelling approach	S. Selvarajan	1996	1999
Agricultural research prioritization and resource allocation	Suresh Pal	1996	1999
Diagnostic study on constraints in agricultural development in western Uttar Pradesh	G. Singh	1999	2000
Networking of social scientists using internet technologies	Rajni Jain	1999	2001
Scope of agriculture based interventions for sustainable nutritional security	P. Adhiguru	1999	2000

VIII Consultancy, Patents and Commercialisation of Technology

The research programmes and outreach activities of NCAP are expanding in view of the increasing demand for socio-economic inputs for policy analysis. The Centre is evolving multiple mechanisms to exploit the existing complementary linkages among national and international agricultural research institutions for feeding social science inputs into agricultural technology management. Integrating the research focus on targeted areas with more breadth and depth of coverage is the goal, sought to be pursued, through such mechanisms, which include consultancy and contract research activities initiated during this year. The consultancy and contract research activities have been broadly formalised as per the Council's guidelines and specifically designed to complement the ongoing and emerging research thrusts and supplement the budgetary resources of the Centre.

Following individual consultancy services and contract research in collaborative mode were provided by the Centre during this year.

Consultancy/Contract Research

Name	Institution to which consultancy/ contract research is provided	Area of consultancy/ contract research
P.K. Joshi	ICRISAT, Hyderabad	Chickpea and pigeon pea: facts, trends and outlook
Ramesh Chand	CGPRT Centre, ESCAP, Bogor, Indonesia	Trade liberalisation and Indian agriculture
Rasheed Sulaiman V	ICRISAT, Hyderabad	Optimising institutional arrangements for demand driven post harvest research, delivery, uptake and impact on the livelihoods of the poor through public and private sector partnerships
S. Selvarajan	ICRISAT, Hyderabad	Methodology for validating rainfed typology

IX RAC. MO and SRO Meetings

Research Advisory Committee (RAC)

The composition of Research Advisory Committee of the Centre w.e.f February 8, 1999 is as follows.

Dr. S.S. Johl
Chairman
21 , Gurudev Nagar
Ludhiana
(Punjab)

Dr. P.K. Joshi
(Member Secretary)
Principal Scientist
ational Centre for Agricultural
Economics and Policy Research
Library Avenue, New Delhi

Dr. G.S. Bhalla
Centre for Study in Regional
Development.
Jawaharlal Nehru University
New Delhi

Dr. S.S. Acharya
Director
Institute of Development
Studies
8-B, Jhalana Institutional Area
Jaipur, Rajasthan

Dr. Ashok Gulati
Institute of Economic Growth
Delhi University
Delhi

Dr. S.S. Bisaliah
Vice Chancellor
University of Agricultural
Sciences, Hebbal
Bangalore

Dr. J.C. Kanwar
Rtd. Jt. Addl. Registrar
Cooperative Societies
Department of Cooperation
Govt. of Punjab
Chandigarh

Dr. Mruthyunjaya,
ADG(ESM), ICAR
Krishi Bhawan,
New Delhi

Dr. Dayanatha Jha
Director
National Centre for Agricultural
Economics and Policy
Research,
Library Avenue, New Delhi

Dr. Bhogendra Jha
Ex-Member of Parliament
Madhubani, Bihar

Dr. P.V. Subba Rao
1-2-597/14, Lower Tank Bund
Road, Hyderabad

Research Advisory Committee meeting (13 August 1999)

The major observations of the RAC meeting are as follows :

National Centre for Agricultural Economics and Policy Research (NCAP) should act as a "think tank" for the agricultural policy makers. The Centre should initiate debates and dialogues on important policy issues and should prepare brief review papers on important themes.

The Centre should balance the research agenda by shifting emphasis and integrating technology policy with issues related to institutions, trade, marketing, agro-processing, etc.

Management Committee (MC)

The current composition of the Management Committee of the Centre is given below.

Dr. Dayanatha Jha
(Chairman)
Director National Centre for Agricultural
Economics and Policy Research
Library Avenue, New Delhi

Dr. R.C. Gautam
Head
Division of Agronomy
Indian Agricultural Research
Institute Pusa, New Delhi

Dr. P. K. Joshi
Principal Scientist
National Centre for Agricultural
Economics and Policy Research
Library Avenue, New Delhi

Dr. Harish Gupta
Scientist (Senior Scale)
Indian Council of Agricultural
Research
Krishi Bhawan, New Delhi

Dr. Mruthyunjaya
Assistant Director-General
(Economics, Statistics and Marketing), ICAR
Krishi Bhawan, New Delhi

Mr. Narender Kumar
(Member Secretary)
Assistant Administrative Officer
National Centre for Agricultural
Economics and Policy Research,
Library Avenue, New Delhi

Dr. Ramesh Chand
Principal Scientist
National Centre for Agricultural
Economics and Policy Research Library Avenue, New Delhi

Management Committee meeting (7June 1999)

The major observations of the Committee are indicated below.

The committee opined that for effective financial monitoring project based budgeting should be given top priority. While presenting the budget, expenditure classification by Plan, Non-Plan and other externally funded sources alongwith resource generation sources should also be indicated. The committee also suggested a need based HRD plan for scientists, technical and administrative staff.

Staff Research Council (SRC) Meetings

Twelve meetings of the SRC were held during the period. Progress of the on-going research programmes was reviewed in these monthly meetings. Some new research proposal were reviewed and approved for commencement. Some major decisions were taken. The SRC was made the final authority to approve research projects. Informal voluntary research teams were formed around each of the research area. Respective program leaders made detailed presentations of the dimensions and perspectives of their research areas. An incentive fund for the administrative, technical and supporting staff was operationalised. An objective and just system for measuring the productivity and performance of scientists was evolved and put for experimentation. Seminars on visits by scientists to institutions and conferences abroad were arranged. Proposals for seminars and workshops were discussed.

Other Committees

The following committees have been constituted for decentralised management.

Director's Advisory Committee

Dr. P.K. Joshi
Dr. S. Selvarajan
Dr. Ramesh Chand
Dr. B.C. Barah
Dr. T. Haque

Terms of Reference

- To advise the Director in administrative matters

Budget and Policy Committee

Dr. Ramesh Chand (Chairman)
Dr. P.K. Joshi
Dr. Amit Kar
Officer-in-charge, stores
Assistant Administrative Officer
Assistant Finance and Accounts Officer

Terms of Reference

- To plan, review and monitor expenditure and income including those for sponsored projects
- To ensure compliance of proper procedures
- To constitute proper purchase and other committees as and when needed

Publications Review Committee

Dr. T. Haque (Chairman)
Dr. P.K. Joshi
Dr. Selvarajan
Dr. Ramesh Chand
Dr. B.C. Barah
Dr. P. Adhiguru (Secretary)

Terms of Reference

- To plan, format and make recommendations regarding Centre's publications
- To prepare guidelines for and arrange internal and external reviews, and coordinate revisions.
- To help and advise younger faculty on publication related matters.
- To identify printers, and suggest pricing, circulation norms, etc.

Computers and Accessories Committee

Dr. B.C. Barah (Chairman)
Dr. S. Selvarajan
Dr. O.K. Agrawal (IASRI)
Ms. Rajni Jain (Secretary)

Terms of Reference

- To plan and monitor computers/ accessories acquisition for the Centre
- To initiate and supervise LAN and E-mail and computer facilities at the Centre

Official Language Committee

Dr. G. Singh (Chairman)
Dr. Sant Kumar
Ms. P.A. Laxmi Prasanna
Mr. S.K. Yadav
Mr. M.S. Vashisht (Secretary)

Terms of Reference

- To watch the progress of work done in official language from time to time and suggest relevant programmes for improvement
- To organize *Raj Bhasha* week/day as intimated by the Council from time to time
- To report the Council and other agencies on progress from time to time

Consultancy Processing Cell

Dr. S. Selvarajan (Chairman)
Dr. Suresh Pal
Dr. Rasheed Sulaiman V. (Secretary)

Terms of Reference

- To examine the proposal related to consultancy with reference to guidelines of the Council issued from time to time, and recommend appropriate action

Grievance Cell

Dr. B.C. Barah (Chairman)
Dr. P.S.Birthal
Mr. Satinder Kataria
Ms. Umeeta Ahuja (Secretary)

Terms of reference

- To examine the grievances received and suggest follow-up action accordingly.

Women Cell

Mrs. Rajni Jain (Chairperson)
Mrs. Anju
Dr. Harbir Singh
Dr. Alka Singh (IARI)
Ms. Sonia Chauhan (Secretary)

Terms of reference

- To recommend measures for the welfare of the women employee.
- To make recommendations for expeditious relief and redressal of grievances including those related to sexual harassment.

Institute Joint Staff Council

1.	Director, NCAP, New Delhi	Chairman
Official Side		
2.	Dr. S. Selvarajan	Member
3.	Sh. Narender Kumar	Member
4.	Sh. Naresh Kumar	Member
Staff side (Elected Member)		
1.	Sh. Khijali Ram Chaudhary (Representing CJSC)	Member
2.	Sh. M.S. Vashisht Secretary (Staff Side)	Member
3.	Sh. Mahesh Kumar	Member

X Participation in Conferences, Meetings, Seminars and Workshops

Name	Theme and Duration	Place
Anjani Kumar	Sensitisation workshop on 'Research Prioritisation in Irrigated Agro-ecosystem under NATP' (30-31 March 1999)	Central Soil Salinity Research Institute,
	National workshop on 'Networking of Social Scientists in ICAR-SAUs System' (6-7 April 1999)	Karnal NCAP, New Delhi
	Sensitisation workshop on 'Research Prioritisation in Rainfed Agro-eco System under NATP' (1-3 June1999)	Central Research Institute for Dryland Agriculture, Hyderabad
	National workshop on 'Measurement of Productivity in Indian Economy '(9-10 July 1999)	Institute for Human Development , New Delhi
	Second national workshop on 'Networking of Social Scientists' (5 October 1999)	University of Agricultural Sciences, Dharwar
	Seventh Annual Conference of Agricultural Economics Research Association (India) (6-7 October 1999)	University of Agricultural Sciences, Dharwar
	Planning workshop on project 'Economic Analysis of Total Factor Productivity of Agriculture by District and Region' (1-3 November 1999)	IARI, New Delhi
	Workshop on 'Aquaculture Development in India' (6-7 September 1999)	NCAP, New Delhi
Anjani Kumar	International workshop on 'Characterizing and Understanding Rainfed Lowland Environments' (5-9 December 1999)	Rainfed Lowland Rice Research Consortium and International Rice Research Institute (IRRI), Ball, Indonesia
	Review workshop of the project 'Analysis of Productivity Changes and Future Sources of Growth in Rice-Wheat Cropping System' (20 December 1999)	NCAP, New Delhi

Name	Theme and Duration	Place
B. C. Roy	Training workshop on 'Agricultural Research Prioritisation' (1-6 February 1999)	NCAP, New Delhi
	Sensitisation workshop on 'Research Prioritisation of Programmes and Production Systems in Irrigated Agro-ecosystems' (30-31 March 1999)	Central Soil Salinity Research Institute, Karnal
	National workshop on 'Networking of Social Scientists' (6-7 April 1999)	NCAP, New Delhi
	NCAER- IEG-WB workshop on 'Reforms in Indian Agriculture for Growth, Efficiency, Equity & Sensitisation workshop on 'Research Prioritisation in Sustainability' (15-16 April 1999)	India Habitat Centre, New Delhi
	Rainfed Agro-ecosystem' (1-3 June 1999)	Central Research Institute for Dryland Agriculture, Hyderabad
B.C. Roy	Planning workshop of NATP project on on 'Analysis of Productivity Changes and Future Sources of Growth in Rice-Wheat System in Indo-Gangetic Plains' (14-15 September 1999)	Punjab Agricultural University, Ludhiana
	National workshop on 'Networking of Social Scientists' (5 October 1999)	University of Agricultural Sciences, Dharwad
	Seventh Annual Conference of Agricultural Economics Research Association (India) (6-7October 1999)	University of Agricultural Sciences, Dharwad
	Planning workshop of NATP project on 'Economic Analysis of Total Factor Productivity of Agriculture by District and Region' (1-3 November 1999)	Indian Agricultural Research Institute, New Delhi
	Review workshop of NATP project on 'Analysis of Productivity Changes and Future Sources of Growth in Rice-Wheat System in Indo-Gangetic Plains' (20 December 1999)	NCAP, New Delhi
	National workshop on 'Dynamic Crop Simulation Modeling for Agrometeorological Advisory Service' (4-6 January 1999)	National Centre for Medium Range Weather Forecasting, New Delhi

Name	Theme and Duration	Place
Dayanatha Jha	Brainstorming session on 'ICAR Vision 2020' (2-3 April 1999)	National Dairy Research Institute, Karna
	Networking of Social Scientists (6-7 April 1999) NCAER-IEG-WB workshop 'Agricultural Policies Reforms in Indian Agriculture for Growth, Efficiency,	NCAP, New Delhi
	Equity and Sustainability' (15-16 April 1999)	Indian Habitat Centre, New Delhi
	Seventh Annual Conference of Agricultural Economics Research Association (6-7 October 1999)	University of Agricultural Sciences, Dharwad
	Expert meeting on 'Land Use and Land Cover Changes in the Indo-Gangnetic Plains : Data Related Issues" (27-28 October 1999)	Suraj Kund, Faridabad
	59th Annual Conference of Indian Society of Agricultural Economics (1-3 December 1999)	Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur
	NAAS symposium on 'Agricultural Diversification and Nutrition' (December 16-17 1999)	National Institute of Nutrition, Hyderabad
	National conference on 'Oilseed' (4 February 2000)	Directorate of Oilseeds Research, Hyderabad
	Workshop on 'Impact of Agricultural Research' (10-11 February 2000)	ICRISAT, Hyderabad
	Seminar on 'World Food Initiative' (13 February 2000)	M.S. Swaminathan Research Foundation, Chennai
Dayanatha Jha	International conference on 'Managing Natural Resources for Sustainable Agricultural Production in the 21st Century' (14-18 February)	Vigyan Bhawan, New Delhi
M.B. Dastagiri	Seventh Annual Conference of Agricultural Economics Research Association (India), (6-7October 1999)	University of Agricultural Sciences Dharwad, Karnataka
P. Adhiguru	National workshop on 'Farmer Led Participatory Extension' (27-28 November 1999)	Punjab Agricultural University, Ludhiana

Name	Theme and Duration	Place
P.K. Joshi	Workshop on 'Characterization of Rice-wheat Based Cropping System' (19 May 1999)	Project Directorate for Cropping Systems Research, Modipuram
	Workshop on 'Networking of Social Scientists' (6-7 April 1999)	NCAP, New Delhi
	Workshop on 'Prioritisation of Research Programs in Rainfed Agro-ecoregion' (1-3 June 1999)	Central Research Institute on Dryland Agriculture, Hyderabad
	Workshop on 'Prospects of Extra Short Duration Pigeonpea Varieties in North India' (30 September-1 October 1999)	International Crops Research Institute for the Semi-Arid Tropics, at PAU, Ludhiana
P.K. Joshi	Workshop on 'Networking of Social Scientists' (5 October 1999)	University of Agricultural Sciences, Dharwad
	Seventh Annual Conference of Agricultural Economics Research Association (India), (6-7October 1999)	University of Agricultural Sciences, Dharwad
	National Workshop on 'World Food Summit Follow up: Strategies for National Agricultural Development Horizon 2010 '(15 October 1999)	Food and Agriculture Organization and the Ministry of Agriculture, Government of India, New Delhi
	International Workshop on 'Characterizing and Understanding Lowland Rice' (4-8 December 1999)	International Rice Research Institute, at Bali, Indonesia,
	Workshop on 'Impact of Agricultural Research' (10-11 February 2000)	National Centre for Agricultural Economics and Policy Research and the International Crops Research Institute for the Semi-Arid Tropics, Patancheru
P.S. Birthal	Workshop on 'Aquaculture Development in India' (6-7 September 1999)	NCAP, New Delhi
	Workshop on 'Impact of Agricultural Research' (10-11 February 2000)	National Centre for Agricultural Economics and Policy Research and the International Crops Research Institute for the Semi-Arid Tropics, Patancheru

Name	Theme and Duration	Place
S. Selvarajan	National Consultation Framework for Action on India Water Vision 2025 (20-21 September 1999)	New Delhi
	Seminar on 'Minimum Rehabilitation of Minor Irrigation Schemes in Andhra Pradesh' (26 October 1999)	Irrigation Department, Government of A.P Hyderabad
	Expert meeting on 'Land-use and Land Cover Changes in the Indo-Gangetic Plains-Data Related Issues' (28-30 October 1999)	Suraj Kund, Faridabad
	Planning workshop of the project 'Increasing Livestock Productivity in Mixed Crop-Livestock Systems in India' (15-17 November 1999)	ICRISAT, Patancheru, Andhra Pradesh
	International conference on 'Managing Natural Resources for Sustainable Agricultural Production in the 21st Century' (14-18 February 2000)	IARI, New Delhi
Sant Kumar	Training workshop on 'Agricultural Research Prioritisation' (1-6 February 1999)	NCAP, New Delhi
	Sensitisation workshop on 'Research Prioritisation of Programmes	Central Soil Salinity Research Institute, Karnal
	National workshop on 'Networking of Social Scientists' (6-7 April 1999)	NCAP, New Delhi
	Sensitisation workshop on 'Research Prioritisation in Rainfed Agro-ecosystem' (1-3 June 1999)	Central Resarch Institute for Dryland Agriculture, Hyderabad
Sant Kumar	Workshop on 'Aquaculture Development in India' (6-7 September 1999)	NCAP, New Delhi
Suresh Pal	ICAR-industry Interface (8-9 February 2000)	NCAP, New Delhi
	Impact of Agricultural Research in India (10- 11 February 2000)	ICRISAT, Hyderabad
	Annual conference of Indian Society of Agricultural Economics	JNKVV, Jabalpur

Policy Interaction

The Centre and its staff have been involved in a number of activities including informal discussions with academicians and policy makers and analysts. A series of group discussions, brainstorming sessions were organised on important topics involving peers and policy makers. These covered areas like research, policy, economic liberalisation, trade, aquaculture, etc.

Dr. S. Selvarajan, served as a member of the World Bank review missions dealing with irrigation investment prioritisation, O&M funding, water rates and cost recovery related policy formulations under water resources consolidation projects of Orissa and Haryana; Leader of

the Indian mission for formulating the sub-tropical area development programme in Bhutan set up by the Ministry of Agriculture and Cooperation, Government of India; Member of the ICAR subject matter committee for restructuring P.G. curricula in social sciences; Economist member in the expert team to design investment planning for the rehabilitation of minor irrigation infrastructure in Andhra Pradesh, Government of Andhra Pradesh.

Dr. Ramesh Chand served as a member of the group for monitoring the preparation for the mid-term review of WTO agreement on agriculture constituted by the Ministry of Agriculture, Govt. of India.

Dr. Rasheed Sulaiman V. served as a member of the sub-group, monitoring and evaluation of extension component of NATP, Ministry of Agriculture, Government of India; member of the ICAR subject matter committee for restructuring P.G curricula in social sciences.

XI WORKSHOPS/SEMINARS

Workshops, seminars, brain storming sessions were organised periodically on policy related issues of current importance. These were organised either individually by this Centre or in collaboration with national and international institutions. Such events are given below.

- Two-day workshop on 'Networking of Social Scientists' was organised under NATP on April 6-7, 1999 at NCAP, New Delhi. A follow up workshop was organised at University of Agricultural Sciences, Dharwad on October 5, 1999.
- Two-day workshop on 'Aquaculture Development in India: Problems and Prospects' was organised at NCAP, New Delhi in collaboration with Central Institute of Brackishwater Aquaculture, Chennai on September 6-7, 1999.
- A project workshop on 'Sources of Growth for Sustainable Rice-Wheat based Cropping System' was organised at PAD, Ludhiana on September 14-15, 1999. A review workshop was organised at NCAP, New Delhi on December 20, 1999.
- A project workshop on 'Equity Driven Trade and Marketing Policies and Strategies for Improved Performance of Indian Agriculture' was organised at NCAP, New Delhi in collaboration with Australian Centre for International Agricultural Research on November 16-17, 1999.
- Two-day workshop on 'Impact of Agricultural Research', was organised in collaboration with International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) at ICRISAT on February 10-11, 2000.

The salient recommendations emerging from some of these are presented below.

Aquaculture Development in India: Problems and Prospects

Aquaculture sector responded favourably to the economic liberalisation policies initiated in 1991. The area, production and productivity particularly of brackishwater shrimp culture as well as the private investment in this sector increased substantially. The momentum, however, could not last long. After 1994-95, the industry came to a halt. Area kept on increasing, production declined sharply. The growth was largely uncontrolled and unregulated, and started showing negative externalities to the environment and the society. This workshop covered issues of growth and sustainability and their implications for the society and ecology. Main recommendations of the workshop are given in Box 1.

Box 1:Planning for sustained growth of aquaculture

- To sustain the growth, issues concerning ecological and economic sustainability of brackishwater aquaculture and its comparative advantage need to be studied in a multidisciplinary framework with due consideration to food security.
- Brackishwater aquaculture areas should be identified and delineated with the help of remote sensing and GIS techniques.
- Develop adequate legal and institutional measures to regulate the aquacultural activity in ecologically fragile zones.
- Research and development efforts should emphasise multi-species cultures/ technologies suiting the objectives and resources of the clientele.
- Enforce quarantine on fish seed and feed to avoid the entry of unwanted and infected imported material.
- Fix appropriate lease period for ponds in a manner conducive to long term investment and modem methods of aquaculture.
- Strengthen infrastructure for processing and value addition, and support services at the farm level.
- Declining share of high value aqua-products like shrimp in seafood exports calls for a reappraisal by the industry and policy makers in terms of product's competitiveness in the world market, international quality norms and standards, and domestic policies.
- Efforts should be made to identify domestic clientele groups, their product preferences and willingness to consume and pay for seafood through large sample surveys.
- Strengthen the current database, which is neither adequate nor easily amenable to proper empirical policy analysis.

Networking of Social Scientists

Under the aegis of NATP, it is envisaged to integrate the social scientists working in the ICAR and SAUs through a networking mechanism. The need for networking of social scientists has arisen due to the limited availability of both social scientists as well as resources for social sciences activities. In this context, a workshop was organised on 6-7 April, 1999 at NCAP in order to prepare an action plan for the networking of social scientists. As a sequel to this, another workshop was organised on 5th October at UAS, Dharwad to review the progress made so far and to further strengthen and expedite this endeavor.

The workshop at NCAP was aimed at reviewing resource scenario, constraints and research programmes in the participating institutions and to workout the modalities to create a website on social scientists in order to facilitate research information exchange, resource sharing and minimize the response time for addressing methodology related problems and lastly to identify the potential networking areas. The important recommendations of these workshops are presented Box 2.

Box 2: Strengthening social science research

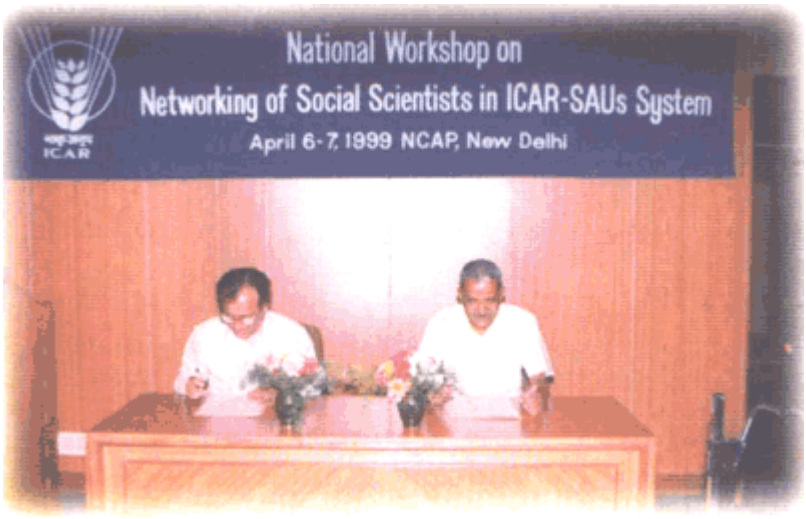
- Research in frontier areas should be strengthened through human resource development and scientists exchange programmes.
- Restructure the course curriculum in the SAUs to incorporate recent advances in the discipline and to maintain uniformity in course contents, requirements and teaching methodology.
- Continuous updating and sharing of available database in a collaborative mode.
- To initiate the work on farm level social science information repository as per the modalities chalked out in the workshop.
- Key priority areas for research in network mode should be identified and work may be initiated. To start with, research prioritisation and impact assessment, potential of agro-processing and diagnostic studies on diversification may be considered for research in network mode.
- The necessary data for website of social scientists should be made available by all ICAR institutes and SAUs.

Impact of Agricultural Research

The purpose of the workshop organised at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru on 10-11 February 2000 under the ICAR-ICRISAT collaborative programme was to document the contribution of agricultural research and development in improving efficiency, conserving natural resources, alleviating poverty and accelerating trade. The workshop was organized into six technical sessions: impact of genetic enhancement research in cereals; impact of genetic enhancement research in pulses and oilseeds; impact of genetic enhancement research in cash crops; impact of natural resource management research; impact of livestock research; impact of crop management and protection research. Following are some of the recommendations (Box3).

Dr. M.S. Swaminathan with NCAP Faculty

Annual Day Celebration



Workshop on Networking of Social Scientists

Box 3: Agenda for social science research

- Commodity-specific studies should be undertaken to estimate the contribution of technology to output growth, and decompose the contribution of agricultural research at aggregate level.
- Agricultural research has helped alleviate poverty. Appropriate methodology need to be adapted or developed to assess the impact of agricultural research on poverty.
- Unlike cereals, oilseeds and cash crops, impact of pulse research was invisible. It was suggested that constraint analysis might be undertaken for the potential technologies confined in the shelves of the research laboratories.
- In order to understand the impact of natural resource management research on sustainability of natural resources, economics research efforts should be initiated to develop appropriate methodologies.
- Research on animal sciences also showed multiple impacts. It was recommended that more in-depth studies might be launched to highlight the contribution of animal science research to the society.
- Social science research should emphasise dissemination of knowledge-intensive research particularly related to integrated pest management and integrated nutrient management.
- To integrate the impact assessment studies with the decision making process on research resource allocation, uniform methodologies (including sampling and analytical approaches) should be used. A network on impact assessment cutting across disciplines may be helpful.

XII Distinguished Visitors

Dr. A.W. Van Den Ban, Consultant on Extension Education, The Netherlands.

Dr. Allan Barden, Australian Centre for International Agricultural Research, Canberra.

Dr. Amresh Hanchate, The London School of Economics and Political Science, London.

Dr. Andrew Hall, International Crops Research Institute for the Semi-Arid Tropics, Hyderabad.

Dr. Ashok Seth, World Bank, New Delhi.

Dr. DP. Chaudhari, University of Wollongong, NSW, Australia.

Dr. K.L. Chaddha, Indian Agricultural Research Institute, New Delhi

Dr. M. Hossain, International, Rice Research Institute, Manila.

Dr. M.S. Swaminathan, M.S. Research Foundation, Chennai.

Dr. N. S. Jodha, International Centre for Integrated Mountain Development, Kathmandu.

Dr. Nelson Perera, University of Wollongong, NSW, Australia.

Dr. P. Hazell, International Food Policy Research Institute, Washington.

Ms.S. Hussain, World Bank, New Delhi.

Dr. Satheesh Aradhyula, The University of Arizona, Tucson.

Dr. Steven J. Staal, International Livestock Research Institute, Kenya.

T.S. Papola, International Centre for Integrated Mountain Development, Kathmandu.

Dr. Yasusho Kitagawa, Japan Centre for International Finance, Japan.

Dr. Z.Y. Zhou, Orange Agricultural College, The University of Sydney, Australia.

XIII Personnel

Posts

The details of the positions sanctioned, filled and remaining vacant at NCAP are given in Table 22.

Table 22 : Positions sanctioned, filled and vacant

S. No	Post (Category wise)	Positions sanctioned	Positions filled	Positions vacant
1.	Director	1	1	-
2.	Principal Scientist	4	4	....
3.	Senior Scientist	6	4	2
4.	Scientist	10	10	-
5.	Assistant Administrative Officer	1	1	-
6.	Assistant Finance and Accounts Officer	1	1	-
7.	Assistant	1	1	-
8.	Senior Clerk	1	1	-
9.	Stenographer	1	1	-
10.	Junior Stenographer	1	1	-
11.	Junior Clerk	2	2	-
12	Technical Assistant	4	4	-
13	Driver	1	1	-
14	S.S. Grade	2	2	-
	Total	**36**	**34**	**2**

List of Staff Members

Scientific

Dayanatha Jha	Director
P.K Joshi	Principal Scientist
S. Selvarajan	Principal Scientist
Ramesh Chand	Principal Scientist
B.C. Barah	Principal Scientist
T. Haque	National Fellow
G.Singh	Senior Scientist
Suresh Pal	Senior Scientist
P.S.Birthal	Senior Scientist
Amit Kar	Senior Scientist
Rasheed Sulaiman, V.	Scientist
P.A. Lakshmi Prasanna	Scientist
P. Adhiguru	Scientist
Rajni Jain	Scientist
B.C. Roy	Scientist
Anjani Kumar	Scientist
A. Ravishankar	Scientist
Sant Kumar	Scientist
Harbir Singh	Scientist
M.B. Dastagiri	Scientist

Administrative

Narender Kumar	Assistant Administrative Officer
Naresh Arora	Asst. Finance & Accounts Officer
M.S. Vasisht	Assistant
Umeeta Ahuja	Steno
Anju	Junior Steno
S.K. Yadav	Senior Clerk
Ravindra Kumar	Junior Clerk
Inderjeet Sachdeva	Junior Clerk

Technical

Khyali Ram Chaudhary	T-4
Mangal Singh Chauhan	T-4
Sonia Chauhan	T-4
Arun Kumar	T-II-3
Satinder Singh Kataria	T-1

Supporting

Mahesh Kumar	S.S. Gr. I
Sanjay Kumar	S.S. Gr. I

XIV Budget

Expenditure pattern during the year 1999-2000 is shown in Table 23.

Table 23 : Expenditure during 1999-2000 (in lakh Rs.)

Head of Account	Plan	Non-Plan	Total
Pay and Allowances	15.6	51.00	66.60
OTA	-	0.15	0.15
Travelling Expenses	4.00	2.00	6.00
Works	126.81	2.00	128.81
Other Charges	40.00	5.0	45.00
Total	**186.41**	**60.15**	**246.56**

XV Infrastructure Development

The budget for strengthening physical infrastructure has been approved in the Ninth Five Year Plan. A piece of land measuring 4338 sq. m has been transferred to NCAP in the IASRI campus. An amount of Rs. 400 lakhs was initially proposed for the office building. This was agreed in principle, out of which Rs. 300 lakhs has been approved for in the Ninth Five Year Plan allocation. The construction work has been handed over to CPWD. Building plan has been finalised and necessary approvals from civic authorities are being expedited. The construction is likely to start soon.

It is proposed to construct 20 staff quarters for NCAP in association with NBSSLUP. An amount of Rs. 100 lakhs was initially proposed, which was agreed in principle, of which 70 lakhs has been allocated in the Ninth Five Year Plan. The initial processing is in progress. A staff car has been acquired during the year.

Library of the Centre is being developed considering complementarities with other ICAR institutes located in Delhi. The emphasis is on development of information services and information sharing. The proposed renovation of library includes provision for on-line connectivity with national and international libraries for sharing information.

Independent desktop computing facility is now available to the entire scientific staff. For effective communication, efficient administration and quick co-ordination, LAN connectivity is provided by linking with Indian Agricultural Statistics Research Institute, to all the scientists of the Centre. LAN nodes are strengthened with more speed and storage to improve the access to the LAN. Scientists have been provided with their personal E-mail accounts at desktop. National networking facilities is going to be provided under the National Agricultural Technology Project.

New initiatives on social science networking, and social science information repository programmes are proposed to fulfil the Centre's HRD mandate of strengthening social science linkages and capacity enhancement within the National Agricultural System.

Innovative and need-based human resource development programmes for scientists, technical and administrative staff along with information support systems have also been designed.

वार्षिक प्रतिवेदन

1999-2000

सारांश

राष्ट्रीय कृषि आर्थिकी एवम् नीति अनुसंधान केन्द्र की स्थापना भारतीय कृषि अनुसंधान परिषद् द्वारा वर्ष 1991 में की गयी। यह केन्द्र भारतीय कृषि सांख्यिकी अनुसंधान संस्थान के परिसर में स्थित है। परिषद के अन्य संस्थानों का सामिप्य इस केन्द्र को कई मूलभूत सुविधाएं उपलब्ध कराता है। केन्द्र में वर्ष 1999-2000 में 20 वैज्ञानिक और 16 अन्य कर्मचारी कार्यरत थे एवं वर्ष का कुल बजट रूपये 265.45 लाख था।

केन्द्र की नीतियों का निर्धारण एक उच्च स्तरीय अनुसंधान सलाहकार समिति करती है एवं प्रो. एस. एस. जोहल इस समिति के अध्यक्ष है। साधारण कार्यकलापों का निर्धारण/संचालन प्रबंध समिति करती है। इसके अतिरिक्त कई अन्य आन्तरिक समितियाँ केन्द्र के दैनिक कार्यों की देख-रेख करती हैं। केन्द्र की प्रथम पंचवर्षीय समीक्षा के लिए डा. वी. एस. व्यास की अध्यक्षता में एक समिति गठित की गई है।

केन्द्र के आज्ञापत्र के अनुसार पाँच मुख्य शोध क्षेत्र निर्धारित हैं यथा तकनीकी नीति, कृषि में स्थायित्व, विपणन एवं व्यापार, संस्थागत बदलाव तथा वृद्धि एवं एकीकरण। उपर्युक्त वर्णित सभी क्षेत्रों में शोध कार्य चल रहे हैं। शोध उपलब्धियाँ एवं जारी शोध कार्य का संक्षिप्त अंश निम्न प्रकार है:

बारानी क्षेत्र में अनुसंधान की प्राथमिकता निर्धारण संबंधी एक शोध में विभिन्न मापदण्डों यथा कार्यक्षमता, सतत विकास एवं समानता आदि के आधार पर मिला कि इस क्षेत्र के चावल आधारित उत्पादन प्रणाली में शोध निवेश 40 प्रतिशत होना चाहिये, जबकि अन्य पद्धतियों जैसे तिलहन, मोटे अनाज एवं कपास में क्रमश: 27 प्रतिशत, 22 प्रतिशत एवं 11 प्रतिशत उचित रहेगा। विभिन्न उत्पादन प्रणालियों में मुख्य फसलों के अतिरिक्त दो प्रमुख क्रियाओं दुग्ध उत्पादन एवं बागवानी में शोध संसाधनों का अधिक आबंटन आवश्यक है। मरू भूमि क्षेत्र में पशुपालन में शोध संसाधन प्रथम स्थान पर होना चाहिये, तदुपरान्त तिलहनों तथा अनाजों को प्राथमिकता मिलनी चाहिये।

शोध क्षेत्र में गरीबी निवारण एवं आय वितरण काफी महत्वपूर्ण मुद्दे हैं। विभिन्न प्रदेशों में कृषि शोध निवेश एवं गरीबी सघनता में ऋणात्मक संबंध रहे हैं। इसी क्रम में एक अध्ययन से पता चलता है कि भारतीय कृषि में भूमि एवं श्रम की उत्पादकता में वृद्धि हुई है। फिर भी, तकनीकी श्रम बचत में परिवर्तन, भूमि उत्पादकता में हुए परिवर्तन से अधिक है। प्रस्तुत अध्ययन भूमि उत्पादकता में उपस्थित बाधाओं को दूर करने की तरफ ध्यान आकर्षित करता है।

शोध संसाधनों से अपेक्षित लाभ प्राप्ति हेतु विभिन्न शोध क्षेत्रों में निवेश काफी महत्वपूर्ण स्थान रखता है। इसी सन्दर्भ में "बारानी क्षेत्र में फसल विविधीकरण" अध्ययन से स्पष्ट हुआ है कि बारानी कृषि काफी विविधीकृत है लेकिन इस क्षेत्र की फसल सघनता एवं वृद्धि बहुत कम है। विभिन्न उपायों जैसे सिंचाई सुविधा का विकास, नमी संरक्षण की विधियाँ अपनाने, जैव-यांत्रिकी तकनीकी का प्रयोग एवं कम अवधि की सूखारोधी जातियों के प्रयोग से, बारानी क्षेत्र की संभाव्य उत्पादकता बढ़ाई जा सकती है।

उपरोक्त के क्रम में, एक उदाहरण आन्ध्र प्रदेश के अपरम्परागत बारानी क्षेत्र में चने के क्षेत्र में हुई वृद्धि से लिया जा सकता है। चने की फसल के क्षेत्रफल में वृद्धि परती एवं कम उपजाऊ भूमि के आने से हुई है, ऐसा चने की अपेक्षा ज्वार की उपज विषमता में बढ़ोत्तरी एवं कम गति से कीमत में बढ़ोतरी से हुआ प्रतीत होता है।

बहुत से ऐसे प्रमाण मिलते है कि सिंचित एवं असिंचित क्षेत्रों के कृषि उत्पादन में बढ़ोतरी की काफी संभावना है। उपरोक्त क्षेत्रों की विभिन्न फसलों की उत्पादन प्रणालियों में बाधक कारकों की पहचान हेतु शोध किये गये। इसी प्रकार सोयाबीन एवं मूँगफली आधारित (बारानी क्षेत्र) उत्पादन प्रणालियों में अनुमानित ह्रास क्रमशः रूपये 2110.6 करोड़ एवं रूपये 3203.3 करोड़ था। सोयाबीन में फली न लगना, गेहूँ में पानी की कमी, चने एवं सोयाबीन में फली बेधक का प्रभाव, तथा खरपतवार एवं कीड़ों का मूँगफली उत्पादन पद्धति में प्रकोप आदि कारक उपज नुकसान के लिए जिम्मेदार पाये गये। सभी उत्पादन पद्धतियों में सामाजिक-आर्थिक कारणों में, उत्पादन कारकों की उपलब्धता में कमी, संस्थागत ऋण सुविधा का अभाव, कीमत जोखिम, आदि प्रमुख पाये गये, इन्हें नीतिगत ढ़ंग से दूर किया जा सकता है।

एक सामान्य धारणा ही बन गयी है कि सिंचित क्षेत्र की उपज में ठहराव सा आ गया है। इसी सन्दर्भ में एक अध्ययन हरियाणा प्रान्त के गंगा के मैदानी क्षेत्रों में किया गया एवं परिणाम विपरीत मिले। उपस्थित तकनीकी बाधाओं में प्रमुख रूप से कीड़े एवं बीमारियाँ, खरपतवार, न्यून बीजांकुरण, असंतुलित उर्वरकों का प्रयोग एवं सामाजिक आर्थिक कारणों जैसे अनियमित बिजली एवं अन्य उत्पादन कारकों की आपूर्ति एवं श्रमिक समस्या आदि हैं। इस प्रकार सिंचित क्षेत्र की उपज शोध प्राथमिकताओं का निर्धारण कर बढ़ाई जा सकती है।

विभिन्न क्षेत्रों में उर्वरकों के दीर्घकालीन प्रयोग से संबंधित एक अध्ययन रासायनिक खादों एवं समन्वित पोषण प्रबंध के तुलनात्मक लाभ के दृष्टिकोण से किया गया। इसमें पाया गया कि धान-गेहूँ सस्यक्रम में केवल रासायनिक खादों का प्रभाव, विभिन्न रासायनिक उर्वरकों तथा जीवांश खादों के मिश्रण की अपेक्षा कम रहा। इस प्रकार पंजाब प्रान्त में प्रायोगिक आकड़ों पर आधारित एक अध्ययन में मिला कि गेहूँ में प्रति हेक्टयेर 53 से.मी. सिंचाई एवं 120 कि.ग्रा. नत्रजन के प्रयोग से 60 कुन्तल प्रति हेक्टर गेहूँ की पैदावार प्राप्त की जा सकती है।

कृषि उत्पादन वृद्धि में जीवनाशी का भी महत्वपूर्ण स्थान है। तकनीकी विफलताओं एवं रासायनिक जीवनाशी के वातावरण एवं समाज पर पड़ने वाले दुष्परिणामों के अध्ययन के बाद, अब समन्वित जीवनाशी प्रबंधन की बात स्वीकार की जाने लगी है। इसी क्रम में एक अध्ययन बारानी क्षेत्र के कपास उत्पादन में 'समन्वित जीवनाशी प्रबंधन' से संबंधित किया गया। परिणामों से पता चला कि समन्वित जीवनाशी प्रबंधन के प्रयोग से न केवल रासायनिक जीवनाशी के प्रयोग में अत्याधिक कमी हुई, बल्कि उपज में कोई कमी नहीं आयी साथ ही में मित्र कीटों की संख्या में भी काफी वृद्धि हुई जो कि प्राकृतिक रूप से जीवनाशी का कार्य करते हैं। इसके प्रयोग से प्रति हेक्टेयर रोजगार सृजन भी बढ़ा।

एक अध्ययन खारा जलीय मछलियों के सन्दर्भ में भी किया गया। इसमें पाया गया कि इस क्षेत्र में आर्थिक उदारीकरण के शुरू के वर्षो में वृद्धि काफी आकर्षक रही। यद्यपि कि 1994-95 के बाद के वर्षों में इस क्षेत्र में वृद्धि हुई परन्तु उपज में ठहराव सा आ गया है, ऐसा इस क्षेत्र से बिगड़ रही पारिस्थितिक संतुलन जैसी भ्रामक स्थित

पैदा होने के कारण हुआ है। समुद्री क्षेत्रों में, इस क्षेत्र के प्रति कानूनी प्रतिबंध भी लगा दिया गया है, इससे क्षेत्र में बड़ी कम्पनियों के निवेश में भी कमी आई है। लेकिन, अध्ययन से पता चलता है कि इस क्षेत्र के भविष्य में विकास की काफी संभावनाएं हैं।

कृषि के सतत विकास में परम्परागत सिंचाई साधनों के महत्व को नकारा नहीं जा सकता। इसी सन्दर्भ में आन्ध्र प्रदेश में तालाब सिंचाई व्यवस्था के अध्ययन में मिला कि तालाब द्वारा सिंचाई व्यवस्था के तिरस्कार करने से लघु सिंचाई सुविधा में कमी आयी है। यह पाया गया कि लघु सिंचाई व्यवस्था में इसके महत्व को स्वीकारने से कृषि विकास में काफी प्रगति की जा सकती है।

वर्तमान आर्थिक सुधारों की प्रक्रिया में निजीकरण एवं साझेदारी की क्रियाओं पर काफी बल दिया गया है। अध्ययन से पता चलता है कि राजकीय कृषि सेवाओं के प्रबंधन के प्रति काफी किसानों ने अप्रसन्नता व्यक्त की एवं लगभग 50 प्रतिशत किसानों ने अधिक मूल्य वाली एवं बागवानी जैसे फसलों के प्रति निजी सेवाओं के पादप संरक्षण एवं प्रशिक्षण में मूल्य चुकता कर उनकी सेवाओं के ग्रहण की बात स्वीकार की।

फसलोत्पादन में उर्वरकों के महत्व के बयान की कोई जरूरत प्रतीत नहीं होती। भविष्य में सघन कृषि विकास हेतु उर्वरकों के प्रयोग बढ़ने की संभावना है। इसी सन्दर्भ में एक अध्ययन से पता चला है कि वर्ष 2007 तक 225 मिलियन टन उर्वरक की आवश्यकता होगी।

हाल के वर्षों में, बीज विपणन में निजी क्षेत्र की भागीदारी हुई है। फिर भी, किसानों तक, बीजों की गुणवत्ता की जानकारी काफी सीमित है। अध्ययन दर्शाता है कि सरकारी क्षेत्र को बीज की गुणवत्ता आदि की जानकारी बढ़ाने हेतु सूचना तंत्र को प्रभावी बनाना चाहिए।

भारतीय अर्थव्यवस्था के विश्वव्यापीकरण के सन्दर्भ में विश्व व्यापार संगठन का कृषि क्षेत्र में पड़ने वाले प्रभाव का अध्ययन किया गया। अध्ययन के परिणामों से इसके विपरीत प्रभाव पड़ने की सम्भावना व्यक्त की गयी। चावल के व्यापार में 18

प्रतिशत शुद्ध वृद्धि की संभावना है जबकि मक्का के सन्दर्भ में यह वृद्धि 81 प्रतिशत आँकी गयी है। सरसों-लाही के व्यापार में उदारीकरण के ऋणात्मक प्रभाव की संभावना है। पशुउत्पादों का व्यापार भी भविष्य में आर्थिक दृष्टि से काफी महत्वपूर्ण क्षेत्र है। एक अध्ययन से निष्कर्ष निकला है कि व्यापार संतुलन इसके पक्ष में था। हाल के वर्षों में पशु उत्पादों के निर्यात में मुख्य रूप से चमड़े एवं चमड़े के सामानों, मांस एवं मांस से बने पदार्थों के व्यापार में वृद्धि आकर्षक रही। एक अन्य संबंधित अध्ययन में दक्षिण एशियाई देशों के आर्थिक संकट में पड़ने के बाद देश के पशु उत्पादों के व्यापार पर पड़ने वाले प्रभाव के बारे में पाया गया कि यद्यपि प्रभाव तो पड़ा है लेकिन प्रभाव आर्थिक दृष्टि से सार्थक नहीं है।

कृषि परिवारों की पोषण सुरक्षा के सन्दर्भ में एक अध्ययन में मिला कि 29 प्रतिशत ग्रामीण परिवार पोषण ग्रस्त हैं। पोषण सुरक्षा, धान-गेहूँ एवं गेहूँ आधारित सस्यक्रम में, धान एवं मोटे अनाजों की फसल कार्य प्रणालियों की तुलना में ज्यादा थी। सिंचाई सुविधा में वृद्धि के साथ पोषण उपलब्धता में धनात्मक संबंध दिखा। पशुपालन आधारित जोत का भी पोषण सुरक्षा की दृष्टि से महत्वपूर्ण स्थान रहा। अतः ऐसा कहा जा सकता है कि हरित क्रांति से पोषण सुरक्षा में काफी योगदान मिला है।

प्रति व्यक्ति सतत आय वृद्धि से अधिक मूल्य वाली वस्तुओं की माँग में बढ़ोतरी होती है। फिर भी अधिक मूल्य वाली वस्तुओं की माँग ग्रामीण (उच्च वर्ग) क्षेत्र में अभी भी कम है। मद्रास शहर में समुद्री उत्पादों के शहरी परिवारों में उपभोग व्यवहार का अध्ययन किया गया। अध्ययन में मिला कि ये परिवार समुद्री उत्पादों में वांछित गुणों जैसे गुणवत्ता, पोषण एवं छाप आदि से युक्त पदार्थों के प्रति, 25 प्रतिशत अधिक मूल्य अदा कर सकते है। समुद्री उत्पादों में झिंग्गा मछली का विशेष रूप से निर्यात किया जाता है। अध्ययन से स्पष्ट है कि भविष्य में इस पदार्थ के निर्यात में कोई बाधा आने पर इसके देश में ही खपत की संभावना तलाशी जा सकती है।

उत्तर प्रदेश में कृषि विविधीकरण के संदर्भ में एक अध्ययन में मिला कि अधिक मूल्य वाली फसलों के प्रति विविधीकरण से उपयुक्त आय एवं रोजगार बढाने की

प्रतिशत शुद्ध वृद्धि की संभावना है जबकि मक्का के सन्दर्भ में यह वृद्धि 81 प्रतिशत आँकी गयी है। सरसों-लाही के व्यापार में उदारीकरण के ऋणात्मक प्रभाव की संभावना है। पशुउत्पादों का व्यापार भी भविष्य में आर्थिक दृष्टि से काफी महत्वपूर्ण क्षेत्र है। एक अध्ययन से निष्कर्ष निकला है कि व्यापार संतुलन इसके पक्ष में था। हाल के वर्षों में पशु उत्पादों के निर्यात में मुख्य रूप से चमड़े एवं चमड़े के सामानों, मांस एवं मांस से बने पदार्थों के व्यापार में वृद्धि आकर्षक रही। एक अन्य संबंधित अध्ययन में दक्षिण एशियाई देशों के आर्थिक संकट में पड़ने के बाद देश के पशु उत्पादों के व्यापार पर पड़ने वाले प्रभाव के बारे में पाया गया कि यद्यपि प्रभाव तो पड़ा है लेकिन प्रभाव आर्थिक दृष्टि से सार्थक नहीं है।

कृषि परिवारों की पोषण सुरक्षा के सन्दर्भ में एक अध्ययन में मिला कि 29 प्रतिशत ग्रामीण परिवार पोषण ग्रस्त हैं। पोषण सुरक्षा, धान-गेहूँ एवं गेहूँ आधारित सस्यक्रम में, धान एवं मोटे अनाजों की फसल कार्य प्रणालियों की तुलना में ज्यादा थी। सिंचाई सुविधा में वृद्धि के साथ पोषण उपलब्धता में धनात्मक संबंध दिखा। पशुपालन आधारित जोत का भी पोषण सुरक्षा की दृष्टि से महत्वपूर्ण स्थान रहा। अतः ऐसा कहा जा सकता है कि हरित क्रांति से पोषण सुरक्षा में काफी योगदान मिला है।

प्रति व्यक्ति सतत आय वृद्धि से अधिक मूल्य वाली वस्तुओं की माँग में बढ़ोतरी होती है। फिर भी अधिक मूल्य वाली वस्तुओं की माँग ग्रामीण (उच्च वर्ग) क्षेत्र में अभी भी कम है। मद्रास शहर में समुद्री उत्पादों के शहरी परिवारों में उपभोग व्यवहार का अध्ययन किया गया। अध्ययन में मिला कि ये परिवार समुद्री उत्पादों में वांछित गुणों जैसे गुणवत्ता, पोषण एवं छाप आदि से युक्त पदार्थों के प्रति, 25 प्रतिशत अधिक मूल्य अदा कर सकते है। समुद्री उत्पादों में झिंग्गा मछली का विशेष रूप से निर्यात किया जाता है। अध्ययन से स्पष्ट है कि भविष्य में इस पदार्थ के निर्यात में कोई बाधा आने पर इसके देश में ही खपत की संभावना तलाशी जा सकती है।

उत्तर प्रदेश में कृषि विविधीकरण के संदर्भ में एक अध्ययन में मिला कि अधिक मूल्य वाली फसलों के प्रति विविधीकरण से उपयुक्त आय एवं रोजगार बढाने की

काफी सम्भावना है। अध्ययन से पता चलता है कि बागवानी फसलों के प्रति विविधीकरण हेतु उपयुक्त वातावरण, विपणन सुविधा एवं कृषि सेवाओं आदि के प्रभावी बनाने की आवश्यकता है।

भारतीय कृषि के विकास में पंजाब प्रान्त का महत्वपूर्ण स्थान रहा है। लेकिन, हाल के वर्षों में इस प्रदेश के कृषि विकास में ठहराव सा आ गया है। राज्य के शुद्ध घरेलू आय, शुद्ध घरेलू कृषि आय एवं प्रति व्यक्ति आय में वृद्धि, औसत राष्ट्रीय आय वृद्धि से कम हो गयी है। इस प्रकार, प्रदेश की आर्थिक व्यवस्था में संभावित वृद्धि हेतु तुलनात्मक आधार पर बागवानी, पुष्पोत्पादन एवं दुग्ध उत्पादन आदि व्यवस्थाओं के अनुपालन की अनुशंसा की जाती है।

कृषि में निवेश के एक अध्ययन में पाया गया कि पिछले दो दशकों में कृषि निवेश में लगभग सभी प्रदेशों में कमी आयी है। राज्यों के शुद्ध घरेलू आय में भी शुरू के अस्सी के दशक में कमी हुई है। राज्यों में प्रति हेक्टेयर निजी पूँजी निवेश में भी काफी असमानता पाई गयी। अध्ययन में सरकारी एवं निजी पूँजी निवेश में तारतम्यता में कमी दिखी। संस्थागत ऋण सुविधा एवं व्यापार शर्त कृषि के पक्ष में होने से निजी क्षेत्र के कृषि में निवेश के प्रमुख कारण हैं। इस प्रकार अध्ययन दर्शाता है कि संस्थागत ऋण सुविधाओं का विकास कृषि में निजी पूँजी निवेश को बढ़ा सकता है।

पिछले वर्ष की भाँति इस वर्ष भी मानव संसाधन प्रशिक्षण पर विशेष ध्यान दिया गया तथा कई प्रशिक्षण कार्यक्रमों में केन्द्र के वैज्ञानिकों तथा तकनीकी सहयोगियों ने भाग लिया। केन्द्र की ओर से भी कुछ प्रशिक्षण कार्यक्रम आयोजित किये गए।

इन सब के साथ-साथ, केन्द्र के वैज्ञानिकों ने सक्रिय रूप से कृषि नीति संबंधी विचार-गोष्ठियों और समितियों में भाग लिया। केन्द्र द्वारा दो नीति प्रपत्र (Policy Paper), पाँच नीति सार (Policy Brief), दो कार्यशाला प्रारूप (Workshop Proceedings) तथा अन्य शोध आलेख प्रकाशित हुए।