# yojana

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A Year of Progress and Prosperity

# Progress with Pride

Qualitative improvement of relations between India and the United States after the Prime Minister's visit.

The Visits of President Clinton of U.S.A. and President Putin of Russia to India add new dynamism to bilateral relations.

With a view to enhancing National Security, Defence expenditure stepped up by Rs. 13,000 crore.

Second generation reforms accelerate economic growth.

Formation of new states of Chattisgarh, Jharkhand and Uttaranchal.

National Commission appointed to review the Constitution.

International community appreciates India's position against terrorism.

Construction of "Golden Quadrilateral" of National Highways taken up.

Development in the field of Information Technology acquires new dimensions.

"Janashree Bima Yojana" for people below poverty line launched.

For Jammu and Kashmir, special Kashir Channel on Doordarshan and All India Radio launched.

All villages with a population of more than one thousand to be connected by roads under the "Pradhan Mantri Gramin Sadak Yojana" in three years.

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# National Agriculture Policy

The national policy on Agriculture seeks to harness the vast untapped potential of Indian agriculture and to strengthen rural infrastructure that is necessary for faster agricultural development. Well being of the farming community, therefore, is one of the foremost aims of the new policy as 200 million Indian farmers and farm workers constitute the backbone of India's agriculture. Therefore, the emphasis is on promoting technically sound, economically viable, environmentally non-degrading and socially acceptable use of country's natural resources.

Agriculture sector has made significant progress after independence. Annual foodgrains production increased four-fold, from about 51 million tonnes in the early fifties to 206 million tonnes at the turn of the century. However, this pattern of growth has also thrown up certain problems like uneven development across regions, degradation of natural resources, capital inadequacy and low rewards in agricultural profession. These problems are sought to be addressed by the new policy by better management of land resources and enriching their fertility.

A long-term perspective plan for sustainable agriculture through watershed approach will be pursued for development of two-thirds of country's cropped area dependent on rain. Stress will also be laid on irrigated horticulture and allied products for adequate food supply and generating surplus for exports.

Allied sectors will be nurtured with care for rejuvenating the rural economy. While latest technology would be deployed to tone up the farm sector, empowerment of women in this sector will receive special attention. There is also the assurance that suitable steps would be taken to protect the interest of farmers in the context of removal of Quantitative Restrictions on imports as per the WTO Agreement on Agriculture. Simultaneously restrictions on the movement of agricultural commodities within the country will be progressively dismantled.

Another significant aspect is the stress on strengthening the data-base for the agriculture sector to ensure greater reliability of estimates and forecasting for better planning and formulation of policies.

In order to make agriculture a rewarding profession the policy aims at promoting favourable economic environment for farmer's own investment and capital formation. This endeavour would be reinforced by removing distortions in the incentive regime for agriculture.

Agriculture is a way of life, a tradition, which, for centuries has shaped the thought, the outlook, the culture and economic life of the people of India. Agriculture, therefore, is and will continue to be central to all strategies for planned socio-economic development of the country. This is the broad perspective for National Policy on Agriculture.

The articles included in this special number present an informed and indepth analysis of some major components of the new policy. ❐

# National Agriculture Policy

***NAP seeks to actualise the untapped potential of agriculture, strengthen rural infrastructure, promote value addition, encourage agro-business, rural employment and secure a fair standard of living for agriculturists.***

AGRICULTURE IS A way of life, a tradition, which, for centuries, has shaped the thought, the outlook, the culture and the economic life of the people of India. Agriculture, therefore, is and will continue to be central to all strategies for planned socio-economic development of the country. Rapid growth of agriculture is essential not only to achieve self-reliance at national level but also for household food security and to bring about equity in distribution of income and wealth resulting in rapid reduction in poverty levels.

Indian agriculture has, since Independence, made rapid strides. In taking the annual foodgrains production from 51 million tonnes of the early fifties to 206 million tonnes at the turn of the century, it has contributed significantly in achieving self sufficiency in food and in avoiding food shortages in our country. The pattern of growth of agriculture has, however, brought in its wake, uneven development, across regions and crops as also across different sections of farming community and is characterized by low levels of productivity and degradation of natural resources in some areas. Capital inadequacy, lack of infrastructural support and demand side constraints such as controls on movement, storage and sale of agricultural products, etc., have continued to affect the economic viability of agriculture sector. Consequently, the growth of agriculture has also tended to slacken during the nineties.

Agriculture has also become a relatively unrewarding profession due to generally unfavourable price regime and low value addition, causing abandoning of farming and increasing migration from rural areas. The situation is likely to be exacerbated further in the wake of integration of agricultural trade in the global system, unless immediate corrective measures are taken.

Over 200 million Indian farmers and farm workers have been the backbone of India's agriculture. Despite having achieved national food security the well being of the farming community continues to be a matter of grave concern for the planners and policy makers in the country. The establishment of an agrarian economy which ensures food and nutrition to India's billion people, raw materials for its expanding industrial base and surpluses for exports, and a fair and equitable reward system for the farming community for the services they provide to the society, will be the mainstay of reforms in the agriculture sector.

The National Policy on Agriculture seeks to actualise the vast untapped growth potential of Indian agriculture, strengthen rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agro business, create employment in rural areas, secure a fair standard of living for the farmers and agricultural workers and their families, discourage migration to urban areas and face the challenges arising out of economic liberalization and globalisation. Over the next two decades, it aims to attain :

- A growth rate in excess of 4 per cent per annum in the agriculture sector;
- Growth that is based on efficient use of resources and conserves

our soil, water and bio-diversity;

- ❖ Growth with equity, i.e., growth which is widespread across regions and farmers;
- ❖ Growth that is demand driven and caters to domestic markets and maximises benefits from exports of agricultural products in the face of the challenges arising from economic liberalization and globalisation;
- ❖ Growth that is sustainable technologically, environmentally and economically.

The policy will seek to promote technically sound, economically viable, environmentally non-degrading, and socially acceptable use of country's natural resources—land, water and genetic endowment to promote sustainable development of agriculture. Measures will be taken to contain biotic pressures on land and to control indiscriminate diversion of agriculture lands for non-agricultural purposes. The unutilized wastelands will be put to use for agriculture and afforestation. Particular attention will be given for increasing cropping intensity through multiple-cropping and inter-cropping.

The Government accords abiding importance to improving the quality of the country's land and soil resources. Reclamation of degraded and fallow lands as well as problem soils will be given high priority to optimize their productive use. Special emphasis will be laid on conserving soils and enriching their fertility. Management of land resources on watershed basis will receive special attention. Areas of shifting cultivation will also receive particular attention for their sustainable development. Integrated and holistic development of rainfed areas will be promoted by conservation of rain water by vegetative measures on watershed basis and augmentation of biomass production through agro and farm forestry with the involvement of the watershed community. All spatial components of a watershed, i.e. arable land, non-arable and drainage lines will be treated as one geo-hydrological entity. Management of grazing land will receive greater attention for augmenting availability of animal feed and fodder. A long-term perspective plan for sustainable rainfed agriculture through watershed approach will be vigorously pursued for development of two thirds of India's cropped area which is dependent on rains.

**The policy will seek to promote technically sound, economically viable, environmentally non-degrading and socially acceptable use of country's natural resources—land, water and genetic endowment—to promote sustainable development of agriculture.**

Rational utilization and conservation of the country's abundant water resources will be promoted. Conjunctive use of surface and ground water will receive highest priority. Special attention will be focused on water quality and the problem of receding ground-water levels in certain areas as a result of over-exploitation of underground aquifers. Proper on-farm management of water resources for the optimum use of irrigation potential will be promoted. Use of insitu moisture management techniques such as mulching and use of micro overhead pressured irrigation systems like drip and sprinkler and green house technology will be encouraged for greater water use efficiency and improving productivity, particularly of horticultural crops. Emphasis will be placed on promotion of water harvesting structures and suitable water conveyance systems in the hilly and high rainfall areas for rectification of regional imbalances. Participatory community irrigation management will be encouraged.

Erosion and narrowing of the base of India's plant and animal genetic resources in the last few decades has been affecting the food security of the country. Survey and evaluation of genetic resources and safe conservation of both indigenous and exogenously introduced genetic variability in crop plants, animals and their wild relatives will receive particular attention. The use of bio-technologies will be promoted for evolving plants which consume less water, are drought resistant, pest resistant, contain more nutrition, give higher yields and are environmentally safe. Conservation of bio-resources through their ex situ preservation in Gene Banks, as also in situ conservation in their natural habitats through bio-diversity parks, etc., will receive a high priority to prevent their extinction. Specific measures will also be taken to conserve indigenous breeds facing extinction. There will be a time bound programme to list, catalogue and classify country's va agro bio-diversity.

Sensitization of the farming community with the environmental concerns will receive high priority. Balanced and conjunctive use of bio-mass, organic and inorganic fertilizers and controlled use of agro chemicals through integrated nutrients and pest management (INM & IPM) will be promoted to achieve the sustainable increase in agricultural production. A nation-wide programme for utilization of rural and urban garbage, farm residues and organic waste for

organic matter repletion and pollution control will be worked out.

Agro-forestry and social forestry are prime requisites for maintenance of ecological balance and augmentation of bio-mass production in the agricultural systems. Agro-forestry will receive a major thrust for efficient nutrient cycling, nitrogen fixation, organic matter addition and for improving drainage. Farmers will be encouraged to take up farm/agro-forestry for higher income generation by evolving technology, extension and credit support packages and removing constraints to development of agro and farm forestry. Involvement of farmers and landless labourers will be sought in the development of pastures/forestry programmes on public wastelands by giving financial incentives and entitlements to the usufructs of trees and pastures.

The history and traditional knowledge of agriculture, particularly of tribal communities, relating to organic farming and preservation and processing of food for nutritional and medicinal purposes is one of the oldest in the world. Concerted efforts will be made to pool, distill and evaluate traditional practices, knowledge and wisdom and to harness them for sustainable agricultural growth.

Special efforts will be made to raise the productivity and production of crops to meet the increasing demand for food generated by unabated demographic pressures and raw materials for expanding agro-based industries. A regionally differentiated strategy will be pursued, taking into account the agronomic, climatic and environmental conditions to realize the full growth potential of every region. Special attention will be given to development of new crop varieties, particularly of food crops, with higher nutritional value through adoption of bio-technology particularly, genetic modification, while addressing bio-safety concerns.

A major thrust will be given to development of rainfed and irrigated horticulture, floriculture, roots and tubers, plantation crops, aromatic and medicinal plants, bee-keeping and sericulture, for augmenting food supply, exports and generating employment in the rural areas.

**An integrated approach to marine and inland fisheries, designed to promote sustainable aquaculture practices will be adopted.**

Availability of hybrid seeds and disease-free planting materials of improved varieties, supported by network of regional nurseries, tissue culture laboratories, seed farms will be promoted to support systematic development of horticulture having emphasis on increased production, post-harvest management, precision farming, bio-control of pests and quality regulation mechanism and exports.

Animal husbandry and fisheries also generate wealth and employment in the agriculture sector. Development of animal husbandry, poultry, dairying and aqua-culture will receive a high priority in the efforts for diversifying agriculture, increasing animal protein availability in the food basket and for generating exportable surpluses. A national livestock breeding strategy will be evolved to meet the requirements of milk, meat, egg and livestock products and to enhance the role of drought animals as a source of energy for farming operations and transport. Major thrust will be on genetic upgradation of indigenous/native cattle and buffaloes using proven semen and high quality pedigreed bulls and by expanding artificial insemination network to provide services at the farmer's doorstep.

Generation and dissemination of appropriate technologies in the field of animal production as also health care to enhance production and productivity levels will be given greater attention. Cultivation of fodder crops and fodder trees will be encouraged to meet the feed and fodder requirements and to improve animal nutrition and welfare. Priority attention will also be given to improve the processing, marketing and transport facilities, with emphasis on modernization of abattoirs, carcass utilization and value addition thereon. Since animal disease eradication and quarantine is critical to exports, animal health system will be strengthened and disease free zones created. The involvement of cooperatives and the private sector will be encouraged for development of animal husbandry, poultry and dairy. Incentives for livestock and fisheries production activities will be brought at par with incentives for crop production.

An integrated approach to marine and inland fisheries, designed to promote sustainable aquaculture practices, will be adopted. Biotechnological application in the field of genetics and breeding, hormonal applications, immunology and disease control will receive particular attention for increased aquaculture production. Development of sustainable technologies for fin and shell fish culture as also pearl-culture, their yield optimization, harvest and post-harvest operations, mechanization of fishing boats, strengthening of infrastructure for production of fish seed, berthing and landing facilities for fishing vessels and development of

marketing infrastructure will be accorded high priority. Deep sea fishing industry will be developed to take advantage of the vast potential of country's exclusive economic zone.

## Generation & Transfer of Technology

A very high priority will be accorded to evolving new location-specific and economically viable improved varieties of agricultural and horticultural crops, livestock species and aquaculture as also conservation and judicious use of germplasm and other biodiversity resources. The regionalization of agricultural research, based on identified agro-climatic zones, will be accorded high priority. Application of frontier sciences like bio-technology, remote sensing technologies, pre and post-harvest technologies, energy saving technologies, technology for environmental protection through national research system as well as proprietary research will be encouraged. The endeavour will be to build a well organized, efficient and result-oriented agriculture research and education system to introduce technological change in Indian agriculture. Upgradation of agricultural education and its orientation towards uniformity in education standards, women empowerment, user-orientation, vocationalization and promotion of excellence will be the hallmark of the new policy.

The research and extension linkages will be strengthened to improve quality and effectiveness of research and extension system. The extension system will be broad based and revitalized. Innovative and decentralized institutional changes will be introduced to make the extension system farmer-responsible and farmer-accountable. Role of Krishi Vigyan Kendras (KVKs), non-governmental organizations (NGOs), farmers organisations, cooperatives, corporate sector and para-technicians in agricultural extension will be encouraged for organizing demand driven production systems. Development of human resources through capacity building and skill upgradation of public extension functionaries and other extension functionaries will be accorded a high priority. The Government will endeavour to move towards a regime of financial sustainability of extension services through affecting in a phased manner, a more realistic cost recovery of extension services and inputs, while simultaneously safeguarding the interests of the poor and the vulnerable groups.

Mainstreaming gender concerns in agriculture will receive particular attention. Appropriate structural, functional and institutional measures will be initiated to empower women and build their capabilities and improve their access to inputs, technology and other farming resources.

## Input Management

Adequate and timely supply of quality inputs such as seeds, fertilizers, plant protection chemicals, bio-pesticides, agricultural machinery and credit at reasonable rates to farmers will be the endeavour of the Government. Soil testing and quality testing of fertilisers and seeds will be ensured and supply of spurious inputs will be checked. Balanced and optimum use of fertilizers will be promoted together with use of organic manures and bio-fertilizers to optimize the efficiency of nutrient use.

Development, production and distribution of improved varieties of seeds and planting materials and strengthening and expansion of seed and plant certification system with private sector participation will receive a high priority. A National Seed Grid will be established to ensure supply of seeds especially to areas affected by natural calamities. The National Seeds Corporation (NSC) and State Farms Corporation of India (SFCI) will be restructured for efficient utilization of investment and manpower.

Protection to plant varieties through a *sui generis* legislation, will be granted to encourage research and breeding of new varieties particularly in the private sector in line with India's obligations under TRIPS Agreement. The farmers will, however, be allowed their traditional rights to save, use exchange, share and sell their farm saved seeds except as branded seeds of protected varieties for commercial purpose. The interests of the researchers will also be safeguarded in carrying out research on proprietary varieties to develop new varieties.

Integrated pest management and use of biotic agents in order to minimize the indiscriminate and injudicious use of chemical pesticides will be the cardinal principle covering plant protection. Selective and eco-friendly farm mechanization through appropriate technology will be promoted, with special reference to rainfed farming to reduce arduous work and to make agriculture efficient and competitive as also to increase crop productivity.

## Incentives for Agriculture

The Government will endeavour to create a favourable economic environment for increasing capital formation and farmer's own investments by removal of distortions in the incentives regime for agriculture, improving the terms of trade with manufacturing sectors and bringing about external and domestic market reforms, backed by rationalization of domestic tax structure. It will seek to bestow on the agriculture sector in as many

respects as possible benefits similar to those obtaining in the manufacturing sector, such as easy availability to credit and other inputs, and infrastructure facilities for development of agri-business industries and development of effective delivery systems and freeing movement of agro produce.

Consequent upon dismantling of Quantitative Restrictions on imports as per WTO Agreement on Agriculture, commoditywise strategies and arrangements for protecting the grower from adverse impact of undue price fluctuations in world markets and for promoting exports will be formulated. Apart from price competition, other aspects of marketing such as quality, choice, health and bio-safety will be promoted. Exports of horticultural produce and marine products will receive particular emphasis. A two-fold long-term strategy of diversification of agricultural produce and value addition enabling the production system to respond to external environment and creating export demand for the commodities produced in the country will be evolved with a view to providing the farmers incremental income from export earnings. A favourable economic environment and supportive public management system will be created for promotion of agricultural exports. Quarantine, both of exports and imports, will be given particular attention so that Indian agriculture is protected from the ingress of exotic pests and diseases.

In order to protect the interest of farmers in context of removal of Quantitative Restrictions, continuous monitoring of international prices will be undertaken and appropriate tariffs *protection* will be provided. Import duties on manufactured commodities used in agriculture will be rationalized. The domestic agricultural market will be liberalized and all controls and regulations hindering increase in farmers' income will be reviewed and abolished to ensure that agriculturists receive prices commensurate with their efforts, investment. Restrictions on the movement of agricultural commodities throughout the country will be progressively dismantled.

The structure of taxes on foodgrains and other commercial crops will be reviewed and rationalized. Similarly, the excise duty on materials such as farm machinery and implements, fertilizers, etc., used as inputs in agricultural production, post harvest storage and processing will be reviewed. Appropriate measures will be adopted to ensure that agriculturists by and large remain outside the regulatory and tax collection systems. Farmers will be exempted from payment of capital gains tax on compulsory acquisition of agricultural land.

## Investment in Agriculture

The agriculture sector has been starved of capital. There has been a decline in the public sector investment in the agriculture sector. Public investment for narrowing regional imbalances, accelerating development of supportive infrastructure for agriculture and rural development particularly rural connectivity will be stepped up. A time-bound strategy for rationalisation and transparent pricing of inputs will be formulated to encourage judicious input use and to generate resources for agriculture. Input subsidy reforms will be pursued as a combination of price and institutional reforms to cut down costs of these inputs for agriculture. Resource allocation regime will be reviewed with a view to rechannelizing the available resources from support measures towards asset formation in rural sector.

A conducive climate will be created through a favourable price and trade regime to promote farmers' own investments as also investments by industries producing inputs for agriculture and agro based industries. Private sector investment in agriculture will also be encouraged more particularly in areas like agricultural research, human resource development, post-harvest management and marketing.

Rural electrification will be given a high priority as a prime mover for agricultural development. The quality and availability of electricity supply will be improved and the demand of the agriculture sector will be met adequately in a reliable and cost effective manner. The use of new and renewable sources of energy for irrigation and other agricultural purposes will also be encouraged.

Bridging the gap between irrigation potential created and utilized, completion of all on-going projects, restoration and modernization of irrigation infrastructure including drainage, evolving and implementing an integrated plan of augmentation and management of national water resources will receive special attention for augmenting the availability and use of irrigation water.

Emphasis will be laid on development of marketing infrastructure and techniques of preservation, storage and transportation with a view to reducing post-harvest losses and ensuring a better return to the grower. The weekly periodic markets under the direct control of Panchayat Raj institutions will be upgraded and strengthened. Direct marketing and pledge financing will be promoted. Producers markets on the lines of Ryatu Bazars will be encouraged throughout the length and the breadth

of the country. Storage facilities for different kinds of agricultural products will be created in the production areas or nearby places particularly in the rural areas so that the farmers can transport their produce to these places immediately after harvest in shortest possible time. The establishment of cold chains, provision of pre cooling facilities to farmers as a service and cold storage in the terminal markets and improving the retail marketing arrangements in urban areas will be given priority. Upgradation and dissemination of market intelligence will receive particular attention.

Setting up of agro-processing units in the producing areas to reduce wastage, especially of horticultural produce, increased value addition and creation of off-farm employment in rural areas will be encouraged. Collaboration between the producer cooperatives and the corporate sector will be encouraged to promote agro-processing industry. An inter-active coupling between technology, economy, environment and society will be promoted for speedy development of food and agro-processing industries and build up a substantial base for production of value added agro-products for domestic and export markets with a strong emphasis on food safety and quality. The Small Farmers Agro Business Consortium (SFAC) will be energized to cater to the needs of farmer entrepreneurs and promote public and private investments in agri-business.

## Institutional Structure

Indian agriculture is characterized by predominance of small and marginal farmers. Institutional reforms will be so pursued as to channelize their energies for achieving greater productivity and production. The approach to rural development and land reforms will focus on the following areas :

- Consolidation of holdings all over the country on the pattern of north western states;
- Redistribution of ceiling surplus lands and wastelands among the landless farmers, unemployed youth with initial start up capital;
- Tenancy reforms to recognize the rights of the tenants and share croppers;
- Development of lease markets for increasing the size of the holding by making legal provisions for giving private lands on lease for cultivation and agri business;
- Updating and improvement of land records, computerization and issue of land pass books to the farmers; and
- Recognition of women's rights in land.

The rural poor will be increasingly involved in the implementation of land reforms with the help of Panchayati Raj institutions, voluntary broup social activists and community leaders.

Private sector participation will be promoted through contract farmer and land leasing arrangements to allow accelerated technology transfer, capital inflow and assured markets for crop production, especially of oilseeds, cotton and horticultural crops.

Progressive institutionalization of rural and farm credit will be continued for providing timely and adequate credit to farmers. The rural credit institutions will be geared to promote savings, investments and risk management. Particular attention will be paid to removal of distortions in the priority sector lending by commercial banks for agriculture and rural sectors. Special measures will be taken for revamping of cooperatives to remove the institutional and financial weakness and evolving simplified procedure for sanction and disbursement of agriculture credit. The endeavour will be to ensure distribution equity in the disbursement of credit. Microcredit will be promoted as an effective tool for alleviating poverty. Self help group—bank linkage system—suited to Indian rural sector, will be developed as a supplementary mechanism for bringing the rural po[illegible] into the informal banking system, thereby improving banks outreach and the credit flows to the poor in an effective and sustainable manner.

## Cooperative Sector

The basic support to agriculture has been provided by the cooperative sector assiduously built over the years. The Government will provide active support for the promotion of cooperative form of enterprise and ensure greater autonomy and operational freedom to them to improve their functioning. The thrust will be on :

- Structural reforms for promoting greater efficiency and viability by freeing them from excessive bureaucratic control and political interference;
- Creation of infrastructure and human resource development;
- Improvement in financial viability and organizational sustainability of cooperatives;
- Democratisation of management and increased professionalism in their operations; and
- Creating a viable inter-face with other grassroots organizations.

The legislative and regulatory framework will be appropriately amended and strengthened to achieve these objectives.

Despite technological and economic advancements, the condition of farmers continues to be unstable due to natural calamities and price fluctuations. National Agriculture Insurance Scheme covering all farmers and all crops throughout the country with built in provisions for insulating farmers from financial distress caused by natural disasters and making agriculture financially viable will be made more farmer specific and effective. Endeavour will be made to provide a package insurance policy for the farmers-right from sowing of the crops to post-harvest operations, including market fluctuations in the prices of agricultural produce.

In order to reduce risk in agriculture and impart greater resilience to Indian agriculture against droughts and floods, efforts will be made for achieving greater flood proofing of flood prone agriculture and drought proofing of rainfed agriculture for protecting the farmers from vagaries of nature. For this purpose, contingency agriculture planning, development of drought and flood resistant crop varieties, watershed development programmes, drought prone areas and desert development programmes and rural infrastructure development programmes will receive particular attention.

The Central Government will continue to discharge its responsibility to ensure remunerative prices for agricultural produce through announcement of Minimum Support Prices policy for major agricultural commodities. The food, nutrition and other domestic and exports requirements of the country will be kept in view while determining the support prices of different commodities. The price structure and trade mechanism will be continuously reviewed to ensure a favourable economic environment for the agriculture sector and to bring about an equitable balance between the rural and the urban incomes. The methodology used by the Commission on Agricultural Costs & Prices (CACP) in arriving at estimates of costs of production will be periodically reviewed. The price structure of both inputs and output will be monitored to ensure higher returns to the farmers and bring about cost effectiveness throughout the economy. Domestic market prices will be closely monitored to prevent distress sales by the farmers. Public and cooperative agencies undertaking marketing operations will be strengthened.

## Future's Market

The Government will enlarge the coverage of futures markets to minimize the wide fluctuations in commodity prices as also for hedging their risks. The endeavour will be to cover all important agricultural products under futures trading in course of time.

Effective implementation of policy initiatives will call for comprehensive reforms in the management of agriculture by the Central and the state governments. The Central Government will supplement/ complement the state governments' efforts through regionally differentiated work plans, comprising crop/area/target group specific interventions, formulated in an inter-active mode and implemented in a spirit of partnership with the states. The Central government will move away from schematic approach to Macro-management mode and assume a role of advocacy, articulation and facilitation to help the states in their efforts towards achieving accelerated agricultural development.

The Government will focus on quality aspects at all stages of farm operations from sowing to primary processing. The quality of inputs and other support services to farmers will be improved. Quality consciousness amongst farmers and agro processors will be created. Grading and standardization of agricultural products will be promoted for export enhancement. Application of science and technology in agriculture will be promoted through a regular system of interface between S&T institutions and the users/potential users, to make the sector globally competitive.

The database for the agriculture sector will be strengthened to ensure greater reliability of estimates and forecasting which will help in the process of planning and policy making. Efforts will be made to significantly improve and harness latest remote sensing and information technology to capture data, collate it, add value and disseminate it to appropriate destinations for managing the risk and in accelerating the growth process. The objective will be to engage in a meaningful continuous dialogue with the external environment in the changing scenario and to have on-line and real time system of 'Agriculture on line' capacity to analyze the signals emanating from the farms and the markets for the benefit of the farmers.

The Government of India trust that this Statement of National Agriculture Policy will receive the fullest support of all sections of the people and lead to sustainable development of agriculture, create gainful employment on a self sustaining basis in rural areas, raise standards of living for the farming communities, preserve environment and serve as a vehicle for building a resurgent national economy. ❐

# NAP and WTO

**Bibek Debroy**

***With two-thirds of the population employed in the rural sector, agricultural reforms are necessary to boost GDP growth rates, reduce poverty and provide employment. That is a minimum commitment. We have to do much more than what the WTO requires us to do.***

THEMATICALLY, ONE CAN divide Uruguay Round (1986-94) agreements into three different heads. First, there are agreements on market access. Examples are industrial tariffs, textiles and garments and agriculture. Second, there are agreements on multilateral rules. Subsidies and countervailing measures, dispute resolution, anti-dumping and safeguards are examples. Third, there are agreements on the new areas—trade-related intellectual property rights, trade-related investment measures and intellectual property rights are examples. Post-Uruguay Round issues like labour and environmental standards, competition policy and electronic commerce are of later vintage.

With the benefit of hindsight, positions on some of these agreements have changed. But while the Uruguay Round negotiations were going on, or atleast in the initial phases, the perception probably was that India would gain in the market access areas and would lose in the new areas. The Uruguay Round agreements entered into force on 1 January 1995. Five years down the line, it is therefore pertinent to ask, has India gained as a result of agricultural liberalization ? If not, why has India not gained and what can be done to remove the constraints ?

But before that, there are four sets of WTO (World Trade Organization) agreements that impinge on agriculture. First, there is the agriculture text proper. Second, there is the sanitary and phytosanitary measures (SPS) agreement. Third, the agreement on intellectual property rights, specifically on micro-organisms and plant and seed varieties has implications for agriculture. Fourth, agreements on industrial tariffs, especially after the phase-out of quantitative restrictions (QRs), have implications for fertilizers and fertilizer policy. While the last two are undoubtedly related, they raise completely different sets of issues. Therefore, we will confine our remarks to the first two.

The contours of the agriculture text are sufficiently well known. Broadly, there are border measures and domestic policy disciplines. On border measures, QRs must be converted to tariffs and tariffs brought down by 36 per cent (over six years) for developed countries and by 24 per cent (over ten years) for developing countries. Export subsidies must be reduced by stipulated percentages on both volume (21 per cent for developed countries and 16 per cent for developing countries) and budgetary (36 per cent for developed countries and 24 per cent for developing countries) terms. In addition, there is a minimum market access commitment of 5 per cent, increasing to 5 per cent over a period of six years. On domestic measures, there is the system of calculating the AMS (Aggregate Measurement of Support), with a threshold AMS level of 10 per cent for developing countries and 5 per cent for developed countries. In excess of the threshold, developed countries have to reduce the base level AMS by 20 per cent. Developing countries have to reduce the base level AMS by 13 1/3 per cent. Certain measures are exempted from AMS disciplines.

Five years and more after the Uruguay Round agreements entered

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into force on 1 January 1995, there is reason for dissatisfaction with the implementation of agriculture sector liberalization. At a conceptual level, there are three kinds of problems. First, agreements have not been implemented and have been violated. Second, agreements have been circumvented. That is, there are practices that violate the spirit of the agreements, though not the law. Third, there are issues that are not yet addressed by existing agreements. Most problems pertain to the last two categories rather than the first. If one remembers two facts, such implementation problems should not be unexpected. First, the Uruguay Round was the first attempt to impose multilateral disciplines on agriculture. Second, the liberalization proposed in the December 1993 package is an imperfect one, unlike the proposed Dunkel Draft, which would have liberalized agriculture much more. Some of the major problems can be listed.

Certain policies (green box, blue box) are exempted from AMS calculations. There have been distortions to artificially transfer subsidies to the green box or the blue box.

Base period (1986-88) AMS levels were high. Consequently, reductions take place on a high AMS and even after stipulated reductions, AMS levels in some countries will continue to be high. This is linked to the argument that no cap has been set on the AMS.

### Export Subsidy

Export subsidy commitments are often at aggregated levels. This allows the flexibility to maintain and even increase subsidies at finer levels of disaggregation.

Allocation of tariff rate quotas (TRQs) is often arbitrary and non-transparent. As long as TRQs exist, they amount to a de facto re-introduction of QRs.

When QRs have been replaced by tariffs, the actual tariffs set are considerably higher than what the tariff equivalents of QRs should have been.

Protection surfaces through the SPS agreement, which allows standards that are higher than internationally accepted standards,

**Five years and more after the Uruguay Round agreements entered into force on 1 January 1995, there is reason for dissatisfaction with the implementation of agriculture sector liberalization.**

provided these have adequate scientific basis. On occasion, protectionism also surfaces through anti-dumping and anti-subsidy investigations.

State trading, government procurement and government monopolies are not sufficiently regulated. Given imperfection of global markets, competition policy is also an issue.

There are two angles to India's negotiations, in terms of what India has to do and in terms of what other countries have to do.

On disciplines that apply to India, the issues are fairly simple. There are not too many problems on border measures, since bound rates for most agricultural commodities range between 100 and 150 per cent, with 300 per cent for some items. One can presume that the empirical work of agricultural economists like Ashok Gulati and Anil Sharma is fairly robust, establishing that barring a few items, India's agricultural products are price competitive. Since liberalization, even if it is imperfect, implies an increase in global prices (with the exact magnitude of the price increase varying from model to model), India's agricultural products are likely to become even more price competitive. Consequently, fears of India being deluged with imports of agro products are generally unrealistic, even if import duties were to be zero. With import duties upwards of 100 per cent, the argument is strengthened. This issue assumes some additional significance because India no longer has access to Article XVIIIB Justification of QRs on balance of payments grounds and barring a small prohibited and banned list, everything will have to be on OGL (open general licence) from 1 April 2001. Many items historically on QRs are agro products, classified as consumer goods. At present, India does not have bound duty commitments on consumer goods. On industrial products, the bound rates are either 25 per cent or 40 per cent. Once the Millennium Round happens, bound duty commitments will also extend to products presently excluded, including consumer goods. There is no reason to create disortions by imposing import duties of more than 40 per cent on agricultural products, while the maximum bound duty on industrial products is 40 per cent. A maximum duty of 40 per cent on agricultural products is thus reasonable.

### Specific Products

While on bound duties, there are some specific products for which there is a problem. More specifically, there were seventeen agro products (skimmed milk powder, coarse foodgrains) for which the bound duties were zero per cent, under the assumption that QRs would exist. These bindings do not date from the Uruguay Round, but go back many years. Naturally, these bindings had to be renegotiated under Article

XXVIII of GATT. A TRQ kind of system has now been imposed. Logically, contesting TRQs in other countries and maintaining them in India does not make sense. Be that as it may, TRQs are now in place. In the process, Article XXVIII negotiations also require compensations to be offered to trading partners. Some compensation must have been offered, but that knowledge is not yet in the public domain. A similar problem exists for DAP fertilizer, with a bound duty of 5 per cent. However, Article XXVIII negotiations on this have not yet begun.

## Methodological Issues

On domestic disciplines, the Indian AMS figure varies from year to year, but there is no denying that it is below the threshold of 10 per cent. Consequently, domestic agricultural reforms do not have to happen because of the WTO. There are certainly methodological issues in computing AMS that need to be cleared up in subsequent negotiations. The AMS methodology is based on differences between the external reference price and domestic administrative price, multiplied by the quantity of production eligible for support. There is no explicit recognition of domestic inflation or currency depreciation. Should one use current exchange rates to convert local currency into US dollars ? Nor is the aggregation of product based subsidies explicit. Can one trade off negative product-level subsidies against positive AMS support ? When AMS is calculated, should the administered price be applied to the entire market or to the quantity that is actually procured ? Subsidies to resource poor or low income farmers are excluded from AMS calculations. How should these be defined ?

Much of India's approach to the agricultural negotiations is characterized by schizophrenia. Will India gain from liberalization. Or does the spectre of PL 480 still haunt us ? If it is accepted that India does gain from global agricultural liberalization, as studies have indeed documented, India can afford to be more aggressive in negotiations, aligning with the Cairns group. India can then argue that blue and green box policies, exempted from AMS calculations, should be disciplined. There should also be a cap on the AMS and the minimum market access commitment can be linked to the actual level of AMS. It can be argued that export subsidy disciplines should be at much finer levels (eight digit, say) and that TRQs should be prohibited. There is a special safeguards clause in the agriculture agreement, which, India does not presently use, because use of the special safeguards clause is linked to the process of tariffication. It is possible to argue, perhaps without much hope of success, that the special safeguards clause should be scrapped. The special safeguards clause states that additional safeguards duty imposed should not exceed one-third the actual import duty in place at that point in time. Failing this, since actual import duties often tend to be high (because agricultural liberalization is staggered), is it possible to argue that safeguards duties should not exceed one-third of bound rates, rather than one-third of actual import duties ?

Finally, there is the matter of the SPS agreement and allied measures related to the environment that act as NTBs. On the limited issue of the SPS, one can argue that scientific criteria need to be much more objective and less arbitrary. However, there is a broader issue concerning links between trade and the environment. For a relatively weak country, stronger multilateral rules ought to be preferable to bilateral negotiations. In the absence of multilateral agreements, unilateral action by developed countries becomes possible. As a counter factual, without denying that the SPS and TBT agreements are not perfect, would it have been preferable for India for there not to be any multilateral agreements at all ? This should really be a rhetorical question. Extrapolating, links between trade and the environment are already with us, such as in the shrimps-turtle dispute. Should one therefore argue for exclusion of such issues in the Millennium Round or press for their inclusion, so that there are multilateral agreements ?

## Domestic Reforms

The schizophrenia towards external liberalization is partly explained by the lack of domestic reforms in Indian agriculture, despite what has happened since 1991. The correlation between agricultural growth and poverty, especially rural poverty, is fairly obvious. Low levels of agricultural productivity and geographical and other limits of the Green Revolution are also fairly obvious. External liberalization can at best be a necessary condition, it is not a sufficient one. What needs to be done to reform domestic Indian agriculture has been known for some time, the problem is really that very few reforms are actually being implemented. Not necessarily in any order of priority items on the agenda are the following.

Eliminate restrictions on inter-state movements of agricultural products. Several of these originate in orders promulgated under the Essential Commodities Act.

Move towards a value added tax (VAT), since local body taxes also hinder inter-state movements.

Allow private sector involvement in rural credit, rural insurance and extension services. For instance, this will lead to a genuine crop insurance system, not what goes by the name of crop insurance now. This should also lead to less wastage in fruits and vegetables and in disintermediation, thus leading to a reduction in the inordinately long distribution chains

that exist. Through disintermediation, the farmer can obtain a better price, without the consumer having to pay a higher price.

Open up futures trading.

Amend land ceiling legislation and facilitate contract farming.

Improve efficiency of government expenditure in agriculture. This implies complete elimination of input subsidies on seeds, fertilizer, power, water or credit. Recovery of appropriate user charges can be ensured through decentralization and local user bodies. If the PDS (public distribution system) is revamped and replaced by food stamps or if procurement is thrown open to the private sector, there can be savings on costs incurred because of the Food Corporation of India's (FCI) inefficiency. With proper targeting of subsidies, output prices can also be increased. There is no reason why a pampered urban middle class should be subsidized. The resultant freeing up of resources can be used to increase public expenditure in rural infrastructure, often a necessary catalyst to stimulate private expenditure.

Decentralization also helps in maintaining rural infrastructure. Maintenance of rural infrastructure is sometimes more important than creating rural infrastructure, a fact that is often lost sight of.

In conclusion, the traditional dichotomy of a backward looking and non-entrepreneurial agriculture and a forward-looking and entrepreneurial industry is not necessarily valid. This dichotomy has been fostered by policy distortions. With two-thirds of the population employed in the rural sector, agricultural reforms are necessary to boost GDP growth rates, reduce poverty and provide employment. The mindset should change. We do not have to do what the WTO requires us to do. That is a minimum commitment. We have to do much more than what the WTO requires us to do. ❐

# Food Security, NAP and WTO

**B. Bhattacharyya**

***Empirical estimates suggest that India is going to be a net importer of foodgrains in near future. Keeping this in view, developing countries like India should think of creation of a 'food security box' in the Agreement (WTO), which may be exempted from any introduction and reduction commitment.***

THERE ARE SEVERAL definitions of what exactly is meant by the concept of 'food security'. The most comprehensive and possibly most acceptable definition is what came out of the World Food Summit at Rome in 1996.

"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."

This definition emphasizes several critical dimensions of food security. First, there must be a physical supply of the desired food in sufficient quantity. Second, there must also be an economic access, e.g., the right to livelihood. So, the issue of purchasing power is closely linked to food security. Third, there must be stability in supply which in a globalised scenario will include access to global food market.

## Global Scenario

Despite substantial increase in global food production, FAO has estimated that about 790 million people in developing countries and about 34 million people in developed and transition economies were suffering from undernourishment during 1995-97. Approximately, 75 percent of these food-insecure population is located in Asia, the Pacific and Sub-Sahara Africa. The largest number of food-insecure people is in India, numbering more than 200 million.

World food security scenario does not look promising. World population, according to UN estimates, is expected to reach 8 billion by 2025, most of the expansion coming from the Third World countries. The major contributory factor in world grains production which has more than doubled since 1960s has been rise in productivity.

The expansion is acreage has been fairly low. Though according to FAO estimates, about 1.8 billion hectare of land can possibly be brought under cultivation, there are certain intrinsic difficulties. These are: part of the land is under reserve forests and, therefore, bringing it into cultivation may not be ecologically desirable; more than two-thirds of the land has some form of soil and other topographical problems; productivity in agricultural production has so far come from new varieties of seeds, more use of chemical fertilizers and improved water usage. But further improvements in these areas are expected to be only incremental in future.

The International Food Policy Research Institute has projected that the 'food gap' (the difference between demand and production of food) in the developing countries may more than double in the coming 25 years.

Agriculture came for the first time under the GATT/WTO discipline in the Uruguay Round when the Agreement on Agriculture (AoA) was negotiated in 1994. The context of the agreement can be understood by looking at the Ministerial Declaration at Punta Del Este launching the Uruguay Round.

"There was an urgent need to bring more discipline and predictability to world agricultural trade by correcting and preventing restrictions and distortions including those related to structural surpluses so as to reduce the

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uncertainty, imbalance and instability in world agricultural market."

This view essentially reflected the realities of the developed world. Excessive subsidy and consequent structural surpluses were and are the concerns of the developed countries. For the developing countries, on the other hand, the issues are low productivity, inadequate public and private investment, lack of access to technology and how to make the entire and growing population food-secure.

The long term objective of the AoA is to establish a fair and market-oriented agricultural trading system and that a reform process should be initiated.... However, the Preamble to the AoA also notes, ..... that commitments under the reform programme should be made in an equitable way among all Members, having regard to non-trade concerns, including food security and the need to protect the environment .."

Most studies reveal that the expectations on the gains arising out of the AoA have not materialised. It was expected that AoA would result in increased access for agricultural exports from developing countries to the markets of the developed countries. In reality, exports to the EU and Japan have declined in proportionate terms in the post Uruguay Round period. It was also expected that there would be a redistribution of grains production from the highly subsidizing West to the less-subsidizing South. There is no evidence that this shift has taken place.

### Article 20

Articles 20 of the AoA provides for renegotiations which is as follows :

Recognizing that the long-term objective of substantial progressive reductions in support and protection resulting in fundamental reform is an ongoing process, Members agree that negotiations for continuing the process will be initiated one year before the end of the implementation period, taking into account :

a) the experience to that date from implementing the reduction commitments;

b) the effects of the reduction commitments on world trade in agriculture;

c) non-trade concerns, special and differential treatment to developing country Members, and the objective to establish a fair and market-oriented agricultural trading system, and the other objectives and concerns mentioned in the preamble to this Agreement; and

d) what further commitments are necessary to achieve the above mentioned long-term objectives.

**It was expected that AoA would result in increased access for agricultural exports from developing countries to the markets of the developed countries. In reality, exports to the EU and Japan have declined in proportionate terms in the post Uruguay Round period.**

Negotiations under Article 20 started in WTO since April 2000. Several countries have submitted their views on the possible contents of the on-going negotiations, including food security. It is obvious that the views of the countries differ substantially since national interests are divergent. Countries which are large exporters of agricultural products including grains, present the view that increased liberalisation in agricultural trade is the best way to ensure global food security. On the other hand, countries which have a large protected agricultural sector, emphasize the role of national food self-sufficiency in the pursuit of food security. The issue of accessing global food market has several dimensions. To purchase food from the international market, the importing countries must have adequate foreign exchange. It has been argued that the high level of export subsidies given by some developed countries on their agro-exports artificially reduces the prices in the market. This affects adversely the competitiveness of the developing countries, which in turn reduces their ability to earn foreign exchange from exports. There is, therefore, a linkage between food security in terms of economic access and the present subsidy regime in the developed countries.Viewed in this perspective, food security in the developing countries can be improved if the developed countries go for massive reductions in their agricultural subsidies. It will however have some adverse impact on the net food-importing developing countries (NFIDC) as this reduction in subsidies may result in an increase in food prices.

### Known Earlier

That NFIDCs may suffer due to the AoA was recognised even when it was negotiated. To help counter the possible adverse impact, the WTO member countries took the 'Decision on Measures Concerning the Possible Negative Effects of the Reforms Programme on Least Developed and Net Food Importing Developing Countries'. The Decision instructs member/countries to facilitate technical and financial assistance to LDCs and NFIDCs so as to improve their agricultural productivity and infrastructure. It also suggests that an increasing proportion of basic food stuffs is provided to LDCs and

NFIDCs in the form of grant.

Countries which are more concerned with preservation of their national agriculture rather than exports, emphasize the issues which point to the need for greater self-sufficiency in the quest for food security. First, the depth of the international grains market is shallow. Amount of wheat traded in the global market was on an average 18.5 percent during 1989-98. The corresponding figure for rice was 4.5 percent. The inadequacy of the global market size becomes apparent if it is considered that the amount of grains globally traded is only 200 million tonnes. According to some estimates China itself may import as much as 59 million tonnes by 2020. Second, only a few producing countries dominate the global food market and crop failure in any one of these countries can affect the food availability in the global food market. For example, the share of the top three largest exporters was 61 percent for wheat, 60 percent for rice, 71 percent for barley, 89 percent for maize and 90 percent for soybeans, based on 1998 data. Third, historically, food has been used as an weapon in international diplomacy. Thus large dependency on imported food may reduce a country's political independence.

## Food Security

The National Agriculture Policy has considered the issue of how to ensure food security for the country in future. India has definitely made rapid strides in foodgrains production—from 51 million tonnes in early 1950s to 206 million tonnes in 1999—which has made the country achieve self-sufficiency in food requirements. However, the continuing increasing population and the opening of agriculture to import competition due to WTO regime necessitate new policy initiatives. This is especially so because the growth rate of agricultural production has decelerated in 1990s.

Since NAP's basic objective is to attain 'sustainable development of agriculture, create gainful employment on a self-sustaining basis in rural areas', all measures proposed under NAP will directly or indirectly contribute to increased food security of the country. However, NAP has specifically proposed several measures directly concerning food security.

**Special attention will be given to the development of new crop varieties, particularly of food crops, with higher nutritional values through adoption of biotechnology, particularly, genetic modification, while addressing bio-safety concerns.**

a) NAP recognises that erosion and narrowing of the base of India's plant and animal genetic resources has been affecting the food security of the country. Therefore, NAP proposes that survey and evaluation of genetic resources and safe conservation of both indigenous and exogenously introduced genetic variability will be accorded particular attention.

b) The use of biotechnology will be promoted. Special attention will be given to the development of new crop varieties, particularly of food crops, with higher nutritional values through adoption of biotechnology, particularly, genetic modification, while addressing bio-safety concerns.

c) The traditional knowledge of agriculture, particularly of tribal communities, relating to organic farming, preservation and processing of food for nutritional and medicinal purposes will be harnessed.

d) To make Indian agriculture globally competitive in the context of removal of quantitative restrictions on agro-imports, commodity-wise strategies and arrangements for protecting the grower from the adverse impact of price fluctuations in the world market will be formulated. Continuous monitoring of international prices will be undertaken and appropriate tariff protection will be given to protect the interest of the farmers.

## Evolving Situation

As far as India is concerned there are some danger signals. Population growth rate and higher per capita income suggest that demand for foodgrains is growing. But doubts are raised about the supply response. In terms of acreage, area under foodgrains has not increased from the 1970-71 level. Yield growth rates of foodgrains are also stagnating in most parts of the country. The productivity of the soil has started declining in Punjab and Haryana. The underground water table in most parts of these states is depleting at a high rate, which in the medium term can cause production of grains, which are water intensive, to fall.

Based on these facts various studies have pointed out that India is going to be a net importer of rice in near future. For wheat, some surplus production will continue to exist in near future. Table 1 and 2 show projection results from an IIFT study.

Some other studies also have

**Table 1**

**Demand and Production: Projection Results for Wheat**

| Year | Estimated Values (in million tonnes) Production | Demand | Production-Demand |
|---|---|---|---|
| 1999-2000 | 76.02 | 66.87 | 9.14 |
| 2000-2001 | 78.53 | 70.12 | 8.41 |
| 2001-2002 | 81.07 | 73.53 | 7.53 |
| 2002-2003 | 83.67 | 77.11 | 6.57 |
| 2003-2004 | 86.36 | 80.85 | 5.51 |
| 2004-2005 | 89.13 | 84.32 | 4.81 |

**Table 2**

**Demand and Production: Projection Results for Rice**

| Year | Estimated Values (in million tonnes) Production | Demand | Production-Demand |
|---|---|---|---|
| 1999-2000 | 86.95 | 86.52 | 0.44 |
| 2000-2001 | 88.48 | 89.67 | -1.19 |
| 2001-2002 | 89.93 | 92.94 | -3.01 |
| 2002-2003 | 91.30 | 96.33 | -5.03 |
| 2003-2004 | 92.59 | 99.84 | -7.25 |
| 2004-2005 | 93.78 | 101.41 | -7.63 |

Source: Bhattacharyya and Pal (1998)

reached similar conclusions.

- R.K. Singh of the Philippines based International Rice Research Institute has also expressed similar concern. According to his projections, India may have to start importing rice by 2005.
- A projection by Krishnaiah and Janaiah of IARI has indicated that demand for rice in 2000 AD will be as high as 132 million tonnes.
- Another projection by IFPRI-IARI has suggested that only under sustained productivity growth in the agricultural sector, India can remain a net food exporter in 2020.
- Ninth Plan projected demand of wheat and rice in 2001-02 to be 78.37 and 94.29 million tonnes respectively.
- Taking a longer term perspective, a recent study by Bhalla, Hazel and Kerr (1999) has shown that large grains deficits may arise due to a shift in consumer preferences in favour of diary and animal protein. The most reasonable estimate reveals that India may face a deficit of 36 million tonnes of seed grains by 2020.
- It has also been pointed out that the notion of India currently surplus in foodgrains production is based on wrong assumptions. According to this view, the demand for foodgrains in India is constrained by the current foodgrains prices and the income level of a large section of the population. According to an FAO estimate, more than 20 percent of India's population do not have access to proper nutrition and are undernourished. If adequate nutrition has to be provided to the entire population, the surplus production in foodgrains may disappear.

Data reveal that in 1998, the annual per capita availability of foodgrains in India was 176.7 kg per capita and India is considered to be a food surplus country. On the other hand, in China, per capita availability of foodgrains in 1994 was about 370 kg per person per year. The Chinese found it inadequate and imported food grains from other countries including India.

Recent estimates suggest that poor spend about 40 percent of their budget on cereals and the well being of the poor in India is directly related to foodgrains prices. Poverty ratios have been found to be positively correlated with foodgrains prices. Elasticity of the poverty ratio to the CPIAL (consumer price index for agricultural labourers) has been found out to be 0.23. This implies that a 20 percent increase in price level will push up the poverty ratio by nearly 4.6 percent if the initial poverty ratio is about 40 percent.

Agricultural trade liberalization can, theoretically speaking, help reduce rural poverty and food insecurity. It contributes to food security in a number of ways: by making up the difference between production and consumption needs; reducing supply variability; fostering economic growth; making more efficient use of world resources; and by permitting global production to take place in those regions more economically suited to it. Empirical studies have found strong negative correlation between poverty ratio and agricultural growth. There is also the possibility of increased production and a resultant increase in rural labour demand and rural real wages. This can help reduce the food insecurity problem by increasing economic access to food. However, widespread

presence of disguised unemployment in India prevent any significant increase in rural real wages.

Also, reliance on trade to bridge the shortfall between production and consumption is not free from risks. The risks include uncertainity of supplies and world market price instability. Access to global market in terms of food security requires access to the required foreign exchange. Given the past level of export performance and the projected global economic conditions, a sustained export performance for most developing countries, including India, appears to be a chimera. Further, when needed, food may not be readily available in the international market if there is a simultaneous shortfall in the major supplying markets, leading to a steep rise in prices. Over and above, dependence on imported food is likely to constrain them in their foreign policy options. For a country of India's size and requirements having adequate food is not tantamount to having access to imported stock of food. This is because at the operational level, the management of handling large-scale imports involving shipping facilities, port infrastructure and internal transport system can put enormous pressures on the already inadequate infrastructure.

Empirical estimates suggest that India is going to be a net importer of foodgrains in near future. FAO studies have also suggested that the liberalization of agricultural trade has increased the risk of food insecurity in many developing countries. Keeping this in view, developing countries like India should try to adapt the WTO agreement to their basic requirement of food security and trade. WTO rules may be reviewed to include a food security clause, allowing, developing countries to follow any policy regime required to create and maintain food security in a country on a sustainable manner. During the next review, the important distinction between trade in staple food and that in other items of agricultural or industrial products must be carefully distinguished. Creation of a 'food security box' in the agreement, which may be exempted from any introduction and reduction commitment, can be thought of.

It will also be necessary to continuously monitor the level of tariff that would be required to protect India's agriculture and whether it is achievable with the bound regime. The relationship between competitiveness of Indian agriculture and the minimum support price mechanism also needs to be monitored. Finally, if there is a possibility that India may turn into a net food importer in medium term, it may be in the interest of India to support the case of net food importers. ❐

# Optimum Use of Water Resource in Agriculture

**D.N. Tewari**

IN 1999-2000 INDIA produced nearly 206 million tonnes of foodgrains from 142 million hectares of cultivated land. The irrigated areas account for 37% of crop land and contribute 55% of food production. The natural resource base, arable land and water which sustain the production process, is under considerable stress. For ensuring food security irrigation system has to be made more effective. The major issue confronting policy makers, planners and development professionals today is how to enhance agricultural production and rural livelihood in a sustainable manner.

Rising biotic pressures, extension of agriculture into fragile ecosystems, over exploitation of groundwater, overuse of chemicals and practice of slash-and-burn agriculture are leading to declining soil health. Farm lands are being made vulnerable due to loss of top soil and small rills have been transformed into wide gullies and ravines. Soil erosion due to wind and water, waterlogging, salinity, alkalinity and improper farming practices are well known causes of soil degradation. It has been said about soils that "a handful of good soil is a miracle. Treated well by man it will support life almost indefinitely. Abuse it, the soil will collapse and die taking man with it."

Preservation of environment and the resource base is essential for sustainable agriculture. Protection, enhancement and restoration of water quality and abatement of water pollution are necessary for providing safe drinking water and improved irrigation. India has a long history of irrigation development. Grand Anicut across Cauvery river delta built in the second century was amongst the earliest irrigation systems. Development of irrigation continued at a slow pace until partition. Since Independence, the government gave higher priority to irrigation to tide over heavy food deficits and consequent imports of foodgrains. Countrywide programmes were taken up which included large river valley projects and medium and minor schemes including groundwater structures. In the states groundwater schemes received priority during the sixties when green revolution occurred and it gathered momentum with increased availability of cheaper power with the spread of rural electrification. Since partition, irrigated area in India rose from 22.60 Mha to 80.76 Mha upto June 1997, against the ultimate target of 140 Mha of which groundwater development has been nearly 50%. Such a large programme has been implemented almost entirely with indigenous technology and equipment.

Soil erosion, sedimentation, deforestation and desertification have led to increased land degradation and creation of reservoirs has in some cases resulted in adverse effect on ecosystems. Many of these problems have arisen from development model that is environmentally destructive due to lack of public awareness and education about surface and groundwater resource protection. There is a widespread lack of perception of linkages between development, management, use and treatment of water resources and aquatic ecosystems. A preventive approach is crucial instead of subsequent measures to rehabilitate, treat and develop new water supplies for increasing agricultural production

***The complex interconnectedness of water systems demand that its management should be holistic and based on a balanced consideration of the needs of people and environment.***

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and to check decline in biodiversity which is source of genetic material needed to make further advances in plant and animal breeding.

## Issues & Imperatives

With the net sown area almost stagnant in the country at about 142 million hectares and 63% of the cultivated land under rainfed, further expansion of irrigation, including additional irrigation through modernisation/renovation of irrigation capacity, is needed as a critical input to achieve the targeted growth rate of agricultural production. Circumstances warrant adoption of following measures for increasing the agricultural production :

i) Continued tendency to start more and more new major and medium irrigation projects resulted in proliferation, thin spreading of resources and consequent time and cost overruns. Concerted efforts have to be made for completion of all ongoing projects, at least those which were started during pre-V Plan period as a time bound programme.

ii) To plan conjunctive use of surface and groundwater resources, right from the initial stage of a water resource development project.

iii) To improve water use efficiency through renovation and modernisation of existing systems.

iv) Water rates to be raised and water use to be rationalised to foster the motivation for economy in water use.

v) Farmers to be involved in the management of irrigation systems in a phased manner.

vi) Development and utilisation of ground water potential particularly in the eastern region to be promoted with reference to technical, environmental and economic considerations through beneficiary-farmers' direct participation in investment, implementation and management.

vii) To promote adaptive research and development to ensure more cost effective and efficient execution and management of irrigation.

viii) To take steps for greater flow of institutional finance in the implementation of minor irrigation schemes.

**With the net sown area almost stagnant in the country at about 142 million hectares and 63% of the cultivated land under rainfed, further expansion of irrigation, including additional irrigation through modernisation/ renovation of irrigation capacity is needed as a critical input to achieve the targeted growth rate of agricultural production.**

ix) To bridge the gap in potential created and utilised by strengthening the Command Area Development programme.

x) To encourage private sector participation in irrigation sector.

xi) India receives 400 million hectares of rainwater annually and nearly 160 million hectare metres fall on agricultural land. Around 24 million hectare metre equivalent rainwater is available for harvesting in small-scale water harvesting structures.

## Causes of Land Degradation

i) Waterlogging and salinity are major problems in some areas and are cited as the consequence of irrigation. There are many causes for waterlogging and salinity being natural or man made as described below :

### Natural Causes

- Poor natural drainage as a consequence of topography or unfavourable sub-soil conditions like existence of hard-pan at shallow depths.
- Spilling of rivers resulting in temporary or seasonal inundation.
- Heavy rainfall, storm surges, estuarine flow, high tides coupled with poor natural drainage.
- Excessive infiltration in higher table lands appearing in low-lying lands through permeable sub-strata.

### Man-made Causes

- Development activities such as construction of roads, bridges, canals, railway embankments, buildings etc. causing impediment to natural drainage.
- Seepage from canals, distributaries, minors and water courses/field channels and leaking structures across canals.
- Supply and application of irrigation water to crops much beyond their evapotranspiration (ET) requirement i.e high water allowances.
- Lack of conjunctive use of canal water and groundwater due to faulty pricing and policies.
- Lack of motivation for night irrigation.
- Poor on-farm water management.
- Inadequate drainage system and deficient maintenance of existing drainage infrastructure.
- The problem of soil salinity

develops in the irrigation command when there is rise in the water table. The salinity/ alkalinity may occur due to one or a combination of following factors :

- ❖ Accumulation of salts due to salty surface or groundwater used for irrigation.
- ❖ Upward movement of salts with capillary rise from lower layers.
- ❖ Use of sodic water for irrigation.
- ❖ Ingress/intrusion of the sea water.
- ❖ High ET demands and low level of salt uptake.
- ❖ Inadequate dose of freshwater to counter upward movement of salts

ii) About 50% of geographical area of the country suffers varying degrees of degradation caused by deforestation, overgrazing, agricultural mismanagement, shifting cultivation, water and wind erosion, waterlogging, alkalinity and salinization. Over 5.3% billion tonnes of top soil is lost every year due to soil erosion. It takes nature about a thousand years to form one cm of soil. The average soil loss is estimated to be over 16 tonnes/hectare/year which translates into approximately 1 mm each year or 1 cm every decade.

iii) For every tonne of foodgrains, about 105 kg of nutrients are removed from the soil; a cereal crop absorbs 35-46 kg of N+P+K to produce a tonne of grain; a grain legume absorbs 210 kg of N+P+K to produce one tonne of grain; grain legumes fix upto 450 kg of nitrogen/hectare/year.

The complex interconnectedness of water systems demand that its management should be holistic (taking catchment and command area development approach) and based on a balanced consideration of the needs of people and environment. Efforts should be made to address the following problems :

i) Water erosion and control measures by adopting :

- ❖ Contour farming;
- ❖ Strip cropping;
- ❖ Conservation cropping system;
- ❖ Mulching and crop residue management;
- ❖ Vegetative barriers on live bunds, ridges and furrows;
- ❖ Waterways with vegetative covers; and
- ❖ Gully plugging

ii) Non-arable and denuded land management may include :-

- ❖ Drainage lines;
- ❖ Insitu moisture conservation measures;
- ❖ Trench and mound fencing;
- ❖ Social fencing; and
- ❖ Vegetative cover—pasture and afforestation

iii) By adopting the integrated watershed approach for rainfed farming which promotes need-based soil conservation measures in arable and non arable lands.

iv) Socio economic alternative to shifting cultivation, environmental sound mining, ecotourism and poverty alleviation programme.

v) By nourishing the land through conservation of rain water, recharging of groundwater and judicious water use.

vi) By anchoring soil to the earth through tree plantation, agroforestry, farm forestry and enhanced green cover.

vii) By enriching soil fertility through planting of leguminous crops and adoption of suitable crop rotations which support diversification.

viii) By adoption of resources conservation technologies such as zero-tillage, reduced tillage, service seeding, bed-planting, use of drip and sprinkler irrigation and agronomic practices that promote precision agriculture, save water, energy and improve productivity.

ix) By empowering local communities to make and implement decisions in order to tap knowledge, enthusiasm and energy and fora for negotiations and conflict resolution.

x) Improving utilisation of irrigation potential and optimising agricultural production and productivity from the irrigation area by integrating all functions of irrigated agriculture.

xi) By educating, informing and sensitising all stakeholders about various aspects of land and water for practising sustainable agriculture.

There are both costs and benefits attached to use of water for increasing agricultural production to feed a population of one billion and growing. Such precious resources must be preserved and nourished. India has no option except to produce more from less per capita arable land and irrigation water in this century. Thus, continuous importance on productivity is essential as also maintaining it for very long. In other words, an 'Evergreen Revolution' routed in the principles of ecology, economics, social and gender equity, energy conservation, employment generation and social auditing is essential, if the goal of "Food for All" is to be achieved. Land and water care constitutes the foundation for building such an 'Evergreen Revolution' movement and protection of environment and for sustainability which is no more an option but an imperative. ❐

# Participatory Watershed Management

**J.S. Samra**

***Watershed boundaries do not recognize artificial land use demarcations like forest, agriculture, etc. and entire area is expected to be developed simultaneously from ridge to valley.***

A WATERSHED IS a naturally defined geographical area that drains to a common point. The concept of sustainable land management on watershed basis is quite ancient in India as evident from frequent hymns in Vedas. Tank irrigation systems, particularly of South India, construction of Guhls (water conveyance channels on contours) in Himalayas, Van Panchayats and a great variety of community based non-statutory institutions are a few examples of our traditional strength. However, development is a dynamically complex process and policy shifts are quite natural to neutralize emerging issues. A major policy change was made in 1954 in establishing a chain of soil and water conservation, research, demonstration and training centres all over India. About 42 micro-watersheds were developed since 1956 with major thrust on biophysical issues especially hydrology. Research findings of this limited experience became basis of launching river valley projects for conserving various catchments in 1961-62. Another paradigm shift in favour of participatory and demand driven watershed management was initiated by Central Soil and Water Conservation Research and Training Institute (CSWCRTI), Dehradun during 1974 (Table-1) Some NGOs also joined in promoting partnership with the people since 1985. Resilience of watershed approach was demonstrated convincingly in the drought year of 1987 when reduction in productivity was far less in treated as compared to untreated watersheds (Fig.1). A large scale National Watershed Development Programme for Rainfed Agriculture (NWDPRA) was launched in 1990-91 by the Ministry of Agriculture & Cooperation. Many environmental benefits like increased green cover, ground water recharging, reduced soil erosion as well as siltation of natural water bodies, regeneration of biodiversity etc. also became evident. Ministry of Rural Areas and Employment also accepted watershed management concept for wasteland restoration in 1994. Hanumantha Rao and Mohan Dharia Committee reports did a great service in operationalizing demand driven and bottom up development of watersheds with people as key players and government/NGO functionaries as service providers. Ministry of Agriculture has also adopted Common Approach from 2 October, 2000 for implementing NWDPRA programme.

Salient features of current paradigm of people-centered watershed management are summarized below.

**Institutional arrangements:** Ministry of Rural Development implements its programmes through District Rural Development Agencies by remitting funds directly to district headquarters. In the NWDPRA programme of Ministry of Agriculture any department like agriculture, watershed development, soil conservation, land development corporations, autonomous Agriculture Technology Management Agency (ATMA) can be identified as nodal agency. The nodal agency further selects Project Implementing Agency (PIA). Any government agency, research organization, NGO,

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Panchayat or a registered voluntary body under society's or Charitable Act can become Project Implementing Agency (PIA). They organize watershed community into user groups, self help groups and ultimately watershed association by arranging general body meeting of all eligible voters (Gram Sabha). The office bearers are nominated with representatives preferably of user groups, self help groups, Panchayats, PIA, women, disadvantaged sects, etc. User and self help groups are created for promoting small production system, micro-enterprising and meeting credit needs. These alternative institutional arrangements have been experimented extensively during past four years.

**Entry Point Activities :** A maximum of three per cent funds are earmarked to create rapport or take up confidence building activities. Discussions are made with the watershed dwellers to elicit immediate need felt by the largest number of stakeholders. It could be installation of a hand pump, distilling of a village pond, tailoring training to girls/women, etc.

**Transparency :** Establishment of closer honesty between villagers and service providers by opening and operating joint accounts is a landmark strategy of sustainable participatory development. Cash books, bills and vouchers are also expected to be kept in the villages. Initial reluctancy of government functionaries for jointly signing of cheques is fading away rapidly. Feed back from projects implemented by GOs, NGOs and international donors has revealed high empowerment of community and assuming of greater responsibilities.

**Table: 1**

**Growth of Organized Watershed Management Programme in India**

| Year of Start | Watershed Nos./area | Agency/ Scheme | Investment (Rs. In millions) |
|---|---|---|---|
| 1956 | 42 nos. | CSWCRTI | Experimental |
| 1961-62 (RVP) | 3.3 m ha upto 8th plan | 29 catchments in 18 states | 6826 |
| 1980-81 (FPR) | 0.83 m ha | 10 catchments in 8 states | 2640 |
| 1983 | 47 nos. | CSWCRTI & CRIDA | ORP |
| 1987 | 12,000 ha | PIDOW | 300 |
| 1991 | 2497 nos. | NWDPRA | 11285 |
| 1991 | 5 lakh ha | world Bank | 8210 |
| 1991 | 1.3 lakh | DANIDA | 600 |
| 1993 | 2.42 lakh | EEC | 1065 |
| 1994 | 2.54 lakh ha | MRAE | 2157 |
| 1995 | 0.35 lakh ha | ISPWD | 767 |
| 1997 | 2.25 m ha | MoA (All schemes) | 33405 |
| 1997 | 1.88 lakh ha | MoEF | 2739 |
| 1997 | — | MRD | 10820 |
| 1997 | | MERC, Aga Khan Foundation | 200 |

| | | |
|---|---|---|
| PIDOW | — | Participatory Integrated Development of Watersheds |
| ISPWD | — | Indo-Swiss Participatory Watershed Development |
| MRAE | — | Ministry of Rural Areas & Employment |
| DFID | — | Department for International Development (UK) |
| KAWAD | — | Karnataka Watershed Development |
| MERC | — | Management of Environment Resources through communities |

**Contributions:** Farmers are expected to bear 10 to 50 per cent cost of activities on private land and 5 per cent on common land. The contribution rate of SC/ST on individually oriented activities ranges from 5 to 35 per cent and 5 per cent on common activities. This strategy facilitated implementation of farmers' preferred or prioritized activities and in that process inculcated a greater sense of belonging. Farmers contributed mostly in the form of labour or locally available materials such as farm yard manure of stones/sand etc. which they could pick up as usufruct rights. In Rajasthan and some programmes of Madhya Pradesh full wages were paid to the workers and 5 to 10 per cent

extra work was taken up and counted towards contribution. In this system if a land owner does not work himself as a labourer then some body else is contributing for him which amounts to proxy participation. In the Indian Farm Forestry Development Cooperative Ltd. projects, Rs. 4 to 5 per days are deducted from the wages and converted into shares of the workers. In case of Gujarat contributions in cash was realized. In the CSWCRTI implemented projects contributions ranged from 5 to 65 per cent depending upon motivation, activities and location.

**Watershed Development Funds:** Contribution made by all participants are placed into a separate bank account to build up a corpus fund for sustaining the development. Expenditure out of this fund can be incurred only after withdrawal of external financial input. Once the farmers are convinced that their contributions are going to stay with their association it acted as a great incentive and they contributed much more than the stipulated minimum. In the NWDPRA project one per cent of the approved budget is earmarked for ensuring sustainable maintenance of community assets. This one per cent allocation is to be matched by the contributions from farmers or state government. This fund can be further augmented in several ways.

**Women participation:** They constitute more than half of labour input especially in hilly, rainfed and arid eco-system where male migration elsewhere is quite common for supplementing family income. On the contrary they are inadequately empowered except in matriarchical system of North-East, higher Himalayas of Himachal Pradesh/ Uttranchal and Kerala. Several mechanisms of their empowerment have been provided in the common guidelines. Women's groups have been relatively more successful in credit and thrift societies, silkworm rearing, dairying, raising of murseries, poultry, etc. A significant

**Table-2**

**Distribution of budget among different components (NWDPRA Programme)**

| Sl. No. | Components | Allocation of fund (%) |
|---|---|---|
| **A.** | **Management component** | |
| | ● Administration cost | 10.0 |
| | ● Community organization | 7.5 |
| | ● Training programme | 5.0 |
| | Sub total (A) | 22.5 |
| **B.** | **Development component** | |
| | ● Natural Resource Management | 50.0 |
| | ● Farm production system for land owning (enterprising) | 20.0 |
| | ● Livelihood support system for land-less families | 7.5 |
| | Sub total (B) | 77.5 |
| | Total | 100.0 |

**Women's groups have been relatively more successful in credit and thrift societies, silkworm rearing, dairying, raising of nurseries, poultry, etc.**

improvement in their membership, active participation and actual empowerment was noted in Agha Khan Rural Support Programme of Gujarat.

**Involvement of landless/ disadvantaged sects:** Some of the land based programmes in the past did not focus this category of stakeholders adequately. In fact funding norms were based on per hectare basis rather than per person or per family basis. Of course NWDPRA programme of VIII Plan made provisions for small production system to serve landless or small land holders. In the common approach of IX Plan they are motivated to organize into small homogeneous groups of 20-25 members according to their livelihood concerns, social affinity, compatibility etc. Seven and a half per cent funds are allocated specifically for this component. There is a grant available to support revolving fund by contributing upto a maximum limit of two times their saving but not exceeding Rs. 25,000. Productive employment generation is the major concern of livelihood gathering from various activities.

**Convergence :** This is a much larger issue of several dimensions. Heterogeneity in terms of policy, guidelines, norms and institutional arrangement is there across different departments/ministries/donors. Funding norms during VIII Plan varied from Rs. 3500 to 32,000 per hectare. Among several key players

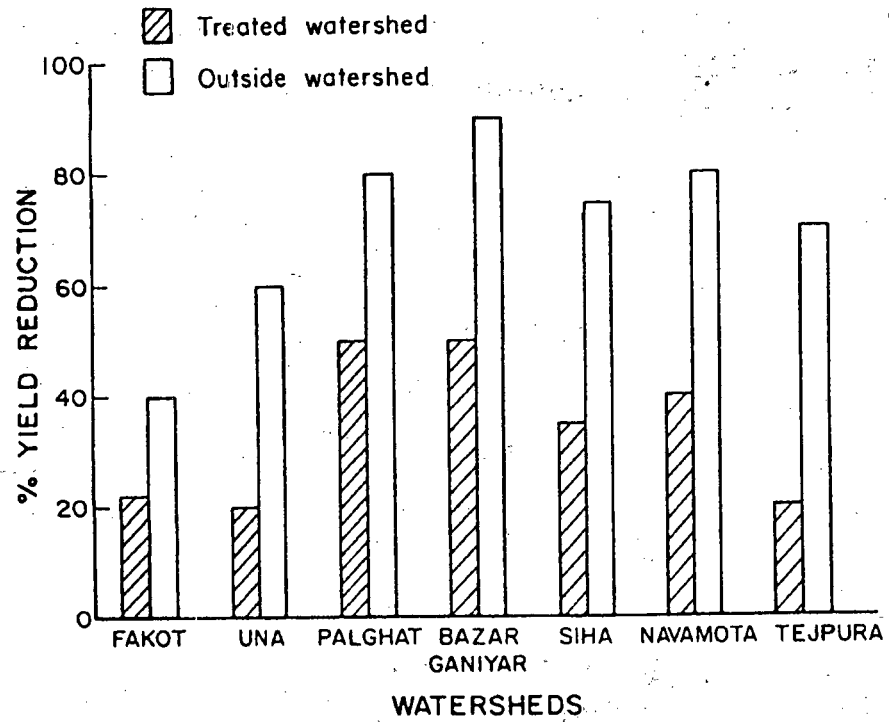


**Fig. 1 Effect of watershed mangaement on drought mitigation (1987).**

common approach has now been agreed to by the Ministry of Rural Development and Ministry of Agriculture (MoA) only. Overlapping has also been avoided in the remaining part of IX Plan by demarcating blocks exclusively for schemes like desert development, drought prone area programme, integrated wastelands development and NWDPRA etc. There is still a long way to go to dovetail the programme with several other rural development schemes.

**Common property resource management :** Free riding behaviour in the exploitation of common or open access resources like grazing lands, forests, fishing, ground water irrigation canals, biodiversity, etc. has afflicted their sustainability adversely. Social fencing through mechanisms of equitable sharing system, incentives, joint forest management, resource use regulation by the community based institutions has been sharpened in the common approach.

**Watershed Budgeting Norms :** Paradigm shift in favour of community organization, capacity building, resource conservation, land based enterprising and livelihood concerns for landless are adequately enshrined in the major budget components described in Table 2. The funding norms of NWDPRA programme of MoA have also been revised to Rs. 4500 and Rs. 6000 per hectare for less than 8 per cent and more than 8 per cent sloping lands, respectively.

**Monitoring and Evaluation :** This role has been assigned to national, state, district and watershed level multi-disciplinary or multi-agency committees. Use of modern tools/ procedures like remote sensing, GIs and information technology has been defined both for concurrent and impact evaluation at the conclusion of the project. A mechanism of internal auditing (every three months) and external auditing (once in a year) has also been provided to enforce accountability. Independent consultants can also be commissioned to analyze and document the process of project implementation.

**Conflicts :** Policy initiatives for improving delivery system are usually obstructed by the jurisdictional, attitudinal and behavioral contradictions. Harmonization between forestry and non-forestry sector is lacking. Watershed boundaries do not recognize artificial land use demarcations like forest, agriculture, etc. and entire area is expected to be developed simultaneously from ridge to valley. Direct remittance to district level is not welcomed by many state headquarters. At district level there are jurisdictional conflicts between bureaucrats (collectors/DCs) and elected representatives (Chairmen Zila Parishads). At village level unhealthy competition between Panchayati and non-Panchayati Raj institutions is quite frequent. There is a kind of dogmatism between GOs and NGOs with a few examples of their joint/harmonious efforts. There could be innumerable situations of disjointed management of vast natural resources. In many cases administrative village boundaries do not coincide with the watershed boundaries and programme has to cut across villages. Conflict resolution is cumbersome, tedious and time consuming mandate. Therefore, capacity building programme to bring about changes in mind-set through conciliatory group dynamics has been accorded high priority in the common approach. ❐

# Widening Horizon of Aquaculture

**K. Gopakumar**

***With a little more strategic planning and investment India's marine product export can easily touch Rs. 10,000 crore mark by 2005. We need a new outlook and philosophy for the fisheries sector at national level duly supported by institutional, legal and R&D.***

AQUACULTURE HAS LONG been existing as an activity for several centuries in Kerala and West Bengal practised by coastal fishermen. However, aquaculture as a scientific farming activity in India started only in the early 1980's. Today India has emerged as a leading producer in the world. Only China and Japan are ahead of India(FAO 2000) (Table 1). The total fish production in the world from capture fisheries shows a declining trend since 1997. India maintains its fish production at a higher level in view of the expanding aquaculture. During 1998, China topped the world in fish production with a figure of 20.80 million mt and India is second producing 2.03 million mt (FAO 2000). Since 1993 India has maintained a sustained level of production from aquaculture with an average annual growth rate of over 6 percent and in some states like Punjab with a production rate of over 13 per cent (Table 2).

## Global Production

In 22 countries of Asia, the aquaculture production has shown an impressive growth of around 10.7%, in weight and 12.3% by value. More than 172 species of fish are cultured in Asia (Table 3).

Fin fishes, particularly Chinese and Indian carps, accounted for the major share (45.6%) of the total aquaculture production. High value marine and diadromous fin fishes collectively account only for 7% of the total value. In value aquatic plants account for US $ 6 million. Crustaceans, although only around 4% by weight of total production, are second most important in terms of value (17%). The top ten items cultured today are given below :

| | |
|---|---|
| Kelp | Laminaria japonica |
| Pacific cuppod oyster | Crassostrea gigas |
| Silver carp | Hypopthalmichthys molitrix |
| Grass carp | Ctenopharyngodon idella |
| Common carp | Cyprinus carpio |
| Unclassified freshwater fishes | Octeichthyes |
| Algae | Aquatic plants |
| Bighead carp | H. nobilis |
| Yessp scallop | Pecten yessoensis |
| Mollusca | Marine mollucs |

## Legislation

Aquaculture has become an industry playing lead role in foreign exchange earnings of many countries like India. In India aquaculture is regulated by state governments since fisheries come under state subject under article 21 of Indian Constitution. At the International level, the adoption of the non-binding Code of Conduct for Responsible Fisheries (CCRF) by the 1995 FAO conference in Rome (FAO 1995) will have a significant impact on aquafarming in Asia as most of the countries have started acceptance of CCRF in a broad based way. Article 9 of the code deals with aquaculture development and gives a set of relevant principles for observance. The first principle in the code is that the states should establish, maintain and develop appropriate legal and administrative framework which facilitates responsible aquaculture. In 1997 FAO also brought in technical guildelines giving general advice in

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**Table 1**

**Fish Production by Countries (million tonnes) 1998**

| Country | Capture | Aquaculture | Total |
|---|---|---|---|
| China | 17.23 | 20.80 | 38.03 |
| Japan | 5.26 | 0.77 | 6.03 |
| India | 3.21 | 2.03 | 5.24 |
| USA | 4.71 | 4.45 | 5.16 |
| Russian Fed | 4.45 | 0.06 | 4.51 |
| Indonesia | 3.70 | 0.70 | 4.40 |
| Chile | 3.27 | 0.29 | 3.56 |

**Table: 2**

**Fish Production (million tonnes) in India**

| Year | Capture | Aquaculture | Year |
|---|---|---|---|
| 1993 | 3.12 | 1.43 | 4.55 |
| 1994 | 3.21 | 1.53 | 4.47 |
| 1995 | 3.22 | 1.69 | 4.91 |
| 1996 | 3.47 | 1.78 | 5.25 |
| 1997 | 3.52 | 1.86 | 5.38 |
| 1998 | 3.21 | 2.03 | 5.24 |

Source: (1) FAO Year Book Fishery Statistics Capture Production Vol. 86/1, 1998

(2) FAO Year Book Fishery Statistics Aquaculture Production Vol.86/2, 1998

support of the implementation of Article 9 of the CCRF. The "Jakarta Mandate" adopted by the second conference of the parties to the Convention on Biological Diversity in 1995, provides useful guidance regarding environmental aspects of aquaculture.

India has already moved in these matters way ahead of other Asian countries by establishing the Aquaculture Authority of India based on the directions of the Hon'ble Supreme Court of India in 1997. This authority is empowered to control coastal shrimp culture by promulgating and adopting appropriate rules and regulation. The power is also vested with this authority to issue licences to shrimp farms.

## Indian Scene

Aquaculture in India has shown a tremendous growth rate. The country is endowed with vast water resources and varying climates to suit the growth of diverse species of fish ranging from snow trout to tropical carps, which can be grown in all parts of India. The country has a coastline

**Table : 3**

**Species of Fish Cultured Globally**

| Area | Species* |
|---|---|
| Africa | 80 |
| North America | 72 |
| South America | 51 |
| Asia | 172 |
| Europe | 99 |
| Ocenia | 54 |
| Former USSR | 35 |

* Some species are grouped into one culture species

*Source: FAO, 1999*

of 8041 kms. The water bodies suitable for aquaculture include 1.4 million brackish water, 2.85 million ponds and lakes, 0.8 million derelict waterbodies and 2.05 million ha of reservoirs. Nowhere in Asia such a bounty of water resources is available for aquafarming and India is second only to China in this respect. As of today we culture more than 20 species of fish and the most important groups are listed in : Table 4

Another development that has taken place in aquaculture in India is integrated fish farming. Integrated fish farming is becoming popular and the various systems adopted by farmers are given in Table 5.

Integrated fish farming is a diversified and coordinated system of producing fish crop/live stock and in a fish farm with fish as the main component for maximal utilization of land and water through recycling of wastes. Paddy-cum-fish culture is a well-known practice in northeast and eastern India from time immemorial. However, the production rates are very low, being less than one tonne fish/ha.

**Freshwater Prawn : M. rosenbergii—harvested from farms.**

## Carp Farming

Carp farming is the mainstay of Indian freshwater aquaculture. Seed production has reached a peak in recent years over 20,000 million fries. A host of carp culture systems are practiced in India viz :

1. Polyculture
   - ❖ Fertilisation and feed-based system
   - ❖ Waste water-based system
   - ❖ Biogas slurry-based system
   - ❖ Aquatic weed-based system
   - ❖ Aquaculture/horticulture-based system
   - ❖ Live stock-based system or integrated fish farming
2. Mono and polyculture of air-breathing fisheries.
3. Mono and polyculture of freshwater products.
4. Cage culture
5. Pen culture
6. Running water fish culture
7. Recirculatory filtering system
8. Molluscan pearl culture

## Shrimp Culture

India has nearly 1.42 million ha of brackishwater area suitable for farming. As on today, around 1.4 lakh ha are used for shrimp farming and during 1998 we produced 82634 tonnes of shrimp, over 90% P. monodon (Tables 6 & 7). Cultured shrimp contributes 52% in terms of quantity and 75% in terms of value of the total export earnings from shrimp (MPEDA, 1999).

## Sustainable Aquaculture

Intensive aquaculture has already showed the adverse impact on production systems. Ecosystems and water bodies that once catered to a diversity of fish species are losing heterogeneity. Fish farmers now practice monoculture, using high yielding species and hybrids. Millions of fingerlings are produced from fever brood stocks. This often results in cannibalism among off-springs. Fish breeders now have less genetic materials. Intensive farming practices and centralization of production systems opened large areas susceptible to out-break of fish diseases. Shrimp diseases have already ravaged farms in West Bengal and Andhra Pradesh. We need sound management practices, which are friendly to environments to have sustained production system.

What is sustainable fishery? It can not be a defined by a single terminology. One thing is obvious. If there is no shrimp export, shrimp farming becomes unsustainable economically. Today even a middle

**Table : 4**

**Some Important Fish Species Cultured in India**

| Fish | Species |
|---|---|
| Shrimp | Penaeus indicus |
| | Penaeus monodon |
| | Penaeus semisulcatus |
| Oyster | Crossostrea madrasensis |
| Mussels | Perna indica, Perna viridis |
| Groupers | Epinephelus tauvina |
| Seaweed | Gracilaria edulis |
| Sea cucumber | Holothuria scabra |
| Clownfish | Amphiprion chyrogaster |
| Seabass | Lates calcarifer |
| Carps | Several species |
| Freshwater prawn | Macrobrachium rosenbergii and M. malcomsoni |

**Table-5**

**Fish Culture Systems Practised in India**

| | |
|---|---|
| Carp culture | 4-6 t/ha/yr |
| Sewage-fed system | 3-5 t/ha/yr |
| Weed based poly culture | 3-5 t/ha/yr |
| Biogas slurry fed system | 3-5 t/ha/yr |
| Integrated farming poultry/pig/horticulture | 3-5 t/ha/yr |
| Intensive pond culture | 10-15 t/ha/yr |
| Pen culture | 4 t/ha/yr |
| Cage culture | 10-15 kg/m2/yr |
| Running water fish culture | 20-50 kg/m2/yr |

class Indian cannot afford to purchase one kilogram P. monodon. In fact quality shrimp has disappeared from the menu of Indian consumer. The net result of stoppage of coastal shrimp farming is unemployment and hunger among the farming community. Aquaculture today provides large-scale employment and income generation among coastal fishermen community. Hence, the concept of environmentally and

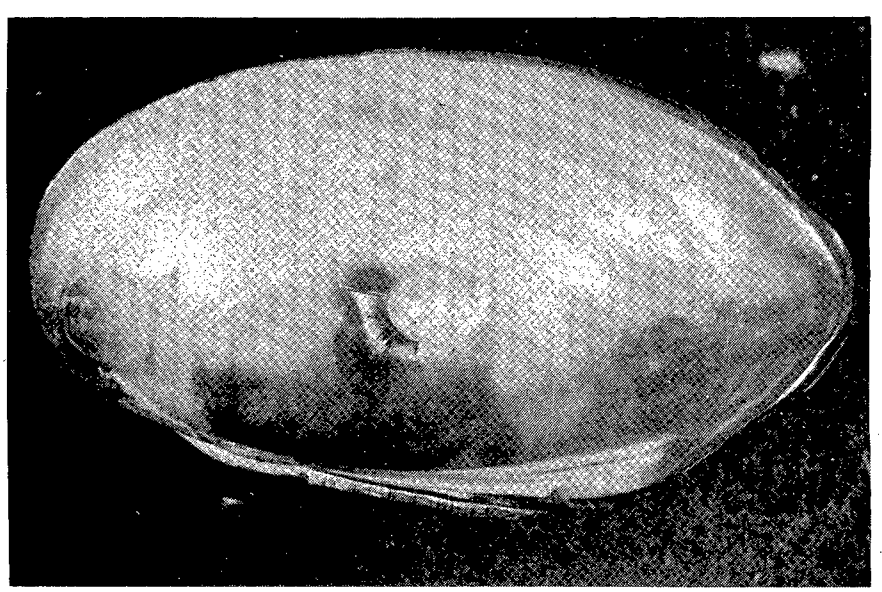
**Intensive farming practices and centralization of production systems opened large areas susceptible to out break of fish diseases. Shrimp diseases have already ravaged farms in West Bengal and Andhra Pradesh.**

ecologically sustainable shrimp farming needs a reexamination as to whether such a concept is one hundred percent acceptable to fish farmers whose sole income is fishing and fish farming. Certainly we need a compromise and policy decision with the involvement of stakeholders, the fishers, the seafood processors and environmentalists, solving major issues for the safety and food security of people.

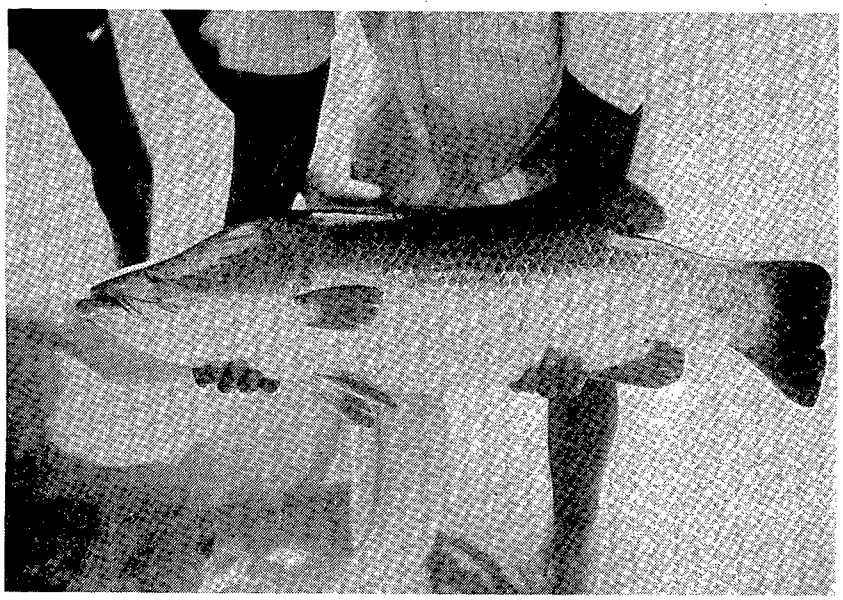
## Agriculture & Fisheries

Many developing nations are listing fisheries out of the agricultural sector for a number of reasons. Agriculture is heavily subsidised in view of the very low profit and little scope for export. However, fishery is highly profit oriented. One hectare of fish farm can give the farmer a minimum of Rs. 70,000 per single crop of fin fish. However, one hectare of shrimp farm can yield a minimum of 4 tonnes of shrimp in two crops. At the present price level of Rs. 200/kg, for P. mondon, (price quoted is lowest one hectare farm can given an income of Rs. 8 lakh and even if half the profit if considered as expenditure the net profit (income minus investment) will be around 3-4 lakh rupees. This is the advantage of shrimp farming compared to fish farming. During the year 1998-1999 March ending our marine products exports crossed for the first time Rs. 5000 crore and more that 70 percent of this amount is contributed by shrimp export. It is also important to note that although farmed shrimp export in terms of quantity is only 52% in terms of value, it contributes 75% of total export earned from shrimp and shrimp based products. This is in view of the important fact that 90% of shrimp exported is P. mondon (Tiger shrimp) which commands a heavy market in export trade. It is to be noted, shrimp export brings hard currencies like dollar and yen.

With a little more strategic planning and investment India's



**Half Pearl in *L. marginalis* (cultured).**



**The Asian Seabass *Lates calcarifer.***

**Table 6 :**

**Indian Shrimp Culture Potential and Utilisation**

| State | Potential area (hectares) | Developed area (hectares) | Area under culture (hectares) | Production (tonnes) |
|---|---|---|---|---|
| W. Bengal | 4 05 000 | 45 525 | 42 067 | 18 326 |
| Orissa | 31 600 | 11 332 | 8 000 | 6 000 |
| A.P. | 1 50 000 | 60 249 | 71 000 | 44 856 |
| TamilNadu | 56 000 | 670 | 1 087 | 1 820 |
| Pondicherry | 800 | 22 | 22 | 27 |
| Kerala | 65 000 | 14 705 | 14 705 | 7 660 |
| Karnataka | 8 000 | 3 540 | 3 564 | 2 690 |
| Goa | 18 500 | 650 | 650 | 590 |
| Maharashtra | 80 000 | 970 | 426 | 409 |
| Gujarat | 3 76 000 | 997 | 316 | 256 |
| Total | 11 90 900 | 1 35 660 | 1 41 837 | 82 634 |

**Table 7**

**Contribution of Aquaculture of Shrimp Export**

| | 1997-98 | | 1998-99 | |
|---|---|---|---|---|
| | Qty. MT | Value (Rs. crore) | Qty. MT | Value (Rs. crore) |
| Total Shrimp Export | 101318 | 3140.56 | 102484 | 3344.90 |
| Cultured Shrimp (Product wt.) | 43464 | 2086.00 | 53300 | 2491.78 |
| Percent Contribution | 42.90% | 66.42% | 52.01% | 74.49% |

marine product export can easily touch Rs. 10,000 crore mark by 2005. Do we need a sustainable fisheries growth ? If so we need a new paradigm. We need a new out look and philosophy for the fisheries sector at national level duly supported by institutional, legal and R & D.

## Future Needs

India's future need of fish has to come mainly from aquafarming. Capture fisheries (marine and inland) has shown a marginal growth. We are already fishing nearly 2.9 million mt of the estimated potential resource of 3.9 million tonnes. Our estimated requirement by 2005 AD will be around 7.5 million mt compared to the present production of 5.8 million (1999). This is the least minimum quantity of fish required if we want to maintain the present level of fish consumption of 9.5 g/person/annum (as estimated by IIM Ahmedabad) taking into account our expected population in 2005 AD. ❐

# Food Processing Industry: Current Scene and Prospects

**Omesh Saigal**

***The food processing industry in India is on an assured track of growth and profitability over the coming decades. It is estimated that it will attract phenomenal investment—capital, human, technological and financial—of over Rs. 1.4 lakh crore in the next decade.***

WITH A TOTAL crop output of 600 million tons (MT) in 1995 only marginally less than the 608 million MT of the United States in the same year we are the world's second largest food producer, after China's 856 MT in 1995. In the production of sugar, tea, milk, fruits and vegetables and rice, we rank either first or second with a share of world production ranging from 10% to 30%. The total value of our processed food sector today is estimated to be around Rs. 70,000 crore, while this output has been assessed to be capable of being raised to Rs. 250,000 crore by year 2008.

Horticultural crops in India are currently grown in 12 million hectares which represents 7 per cent of India's total cropped area. Annual horticultural production is estimated at 131 million metric tonnes, which is over 18 per cent of India's gross agricultural output. India is one of the largest producers of fruits & vegetables with 44 million mt tonnes of fruit production in 1999-00 and vegetable production of 87.5 million mt tons in the same period. India has the world's largest number of livestock and ranks first in the cattle population and is the second largest milk producer in the world.

This is the flip side. The flop side is that the enormous production and its potential is marred by colossal wastage, very low level of processing and non-availability of post-harvest infrastructure. As per the report prepared in 1981 by Shri M.S. Swaminathan, former Member of the Planning Commission, upto 40% of certain fruits and vegetables go waste due to their perishable nature and non-availability of appropriate post-harvest infrastructure. As per another study viz., Technology Information for Costing and Assessment Council (TIFAC) of the Department of Science & Technology published in 1996, wastages in certain fruits is as high as over 30% and in case of vegetables the losses are upto 20-30% at the post harvest stages due to poor storage, transportation/lack of infrastructure and the inadequacy of the marketing set up. India wastes more fruits and vegetables than are consumed in a country like U.K. The total wastage in all food sectors is as high as Rs. 50,000 crore. If even half the wastage could be prevented, we will have enough calories to bring the nutritional status of our poor to above subsistence levels.

Farmers in India only receive 20 to 30 per cent of the retail price of fruits and vegetables. Those in more efficient systems with fewer intermediaries receive as much as 40 to 50 per cent. Milk cooperatives in India have demonstrated that by reducing the number or intermediaries the farmers share of the revenue can be increased from 50 per cent to over 90 per cent of the processor price.

Food Processing Industry is of enormous significance for India's development because of the vital linkages and synergies that it promotes between the two pillars of the economy, namely industry and agriculture. It will give India the potential to become number one in food production with sustained efforts. The growth potential of this

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sector is enormous and it is expected that the food production will double in the next 10 years, marking improvement in consumption of value added foods.

Growth of the Food Processing Industry will also bring immense benefits to the economy, raising agricultural yields, meeting productivity, creating employment and raising the standard of very large number of people throughout the country, specially, in the rural areas. Economic liberalization and rising consumer prosperity is opening up new opportunities for diversification in Food Processing Sector. Liberalization of world trade will further open up new vistas for growth.

The Food Processing Industry has been identified as a thrust area for development. This industry is included in the priority lending sector. Most units of the Food Processing Industry have been exempted from the provisions of industrial licensing under industries (Development and Regulation) Act, 1951 with the exception of beer and alcoholic drinks and items reserved for Small Scale Sector, like vinegar, bread, bakery. As far as foreign investment is concerned automatic approval for even 100% equity is available for majority of the processed food items.

Some startling statistics regarding prospects for the processed food sector in India have been revealed by a study done by Mckinsey & Company recently. Food in our country, it indicates, is already a Rs. 2.5 lakh crore industry. The study visualizes the year 2000 and beyond as a period of immense growth and development in this sector. Not only is the food processing industry estimated to reach a gross value of Rs. 5 lakh crore but value added foods are expected to grow at a much faster rate, i.e., to expand from Rs. 80,000 crore to Rs. 2.25 lakh crore by 2005 AD. By 2005, the study says, some 20 crore people will move from subsistence foods, like cereals and pulses, to basic products demanding more processing. The study points out that inefficiencies in food sector is due to 6-7 intermediaries as compared to 2-3 in other countries. Though the study specifically forecasts major opportunities in processed milk, poultry, packaged atta, and bakery products, processing of fruits and vegetables will not lag behind.

**Food processing industry is estimated to reach a gross value of Rs. 5 lakh crore, but value added foods are expected to grow at a much faster rate i.e., to expand from Rs. 80,000 crore to Rs. 2.25 lakh crore by 2005 AD. By 2005, some 20 crore people will move from subsistence foods, like cereals and pulses, to basic products demanding more processing.**

These estimates of growth of the food processing industry are being aided by our fast changing social structures. The joint family is disintegrating, the number of working women is rising, the per capita income is increasing leading to diversification of food consumption patterns and the upper middle and middle classes are fast increasing. All these will provide a major market for processed foods. Thus whichever way we look at it, the food processing industry in India is on an assured track of growth and profitability over the coming decades. It is estimated that the transition will attract phenomenal investment—capital, human, technological and financial—of over Rs. 1.4 lakh crore in the next decade.

Although we are one of the largest producers of raw materials for the food processing industry in the world, the industry itself is extremely underdeveloped in India. Less than 2% of fruit and vegetable production is processed compared with 30% in Thailand, 70% in Brazil, 78% in Philippines and 80% in Malaysia. The value addition in the food sector is still very low at 7%.

In the last decade, India moved from an era of scarcity to one of plenty. In the production of fruits and vegetables, which was just 50% of the total quantity of foodgrains production, it has now become 66% of the total quantity of production of foodgrains. By the year 2010 it is estimated that the production of fruits and vegetables would be 80% of the quantity of foodgrains produced in India. Coupled with the fact that the yield of these crops in India is just about one-third compared to other countries, we can imagine the sort of spurt that is possible in the sector.

In the situation that prevails in India, 90% of the fruits and vegetables are marketed by the farmers as compared to less than 20% of cereals. This shows that the main challenge the food sector is going to face in the coming decades will be one of marketing, which hitherto has been a major constraint in its growth and it is here that the thrust of our policy will have to be.

In this scenario food processing becomes critical. This would mop up surpluses at farm level and ensure fair price for the producer. It would also ensure availability of the produce at reasonable price for the consumer. In addition, the employment generation potential of this sector is much higher than other sectors, i.e., 54,000 persons

get direct employment per 1000 crore of investment in the food sector in comparison to 48000 in textiles and 25000 in paper industry. There is also a four-fold generation of indirect employment in the ancillary and other downstream activities on account of the investment in the food sector. Further more 60% of the employment generation is in small towns and rural areas.

The primary reason why this sector has not developed is that agriculture has largely been for subsistence and not market driven. This has not yielded adequate surpluses for processing and, coupled with the low yield of crops, has choked it. The lack of awareness about the processable variety of raw material and the non-availability of suitable raw material in terms of size, colour, texture etc., has contributed to the absence of volumes of processable varieties and, therefore, economies of scale. The present tax structure also drives a wedge between branded products manufactured in the organised sector and products from the unorganised sector. In fact, the tax in India on processed food is amongst the highest in the world and this has been a major single impediment in attracting investments, both locally and from abroad. This is coupled with the fact that investments in the processing industries are in any case high risk and yield low returns. Investments are further depressed because despite the apparent advantage of hygiene and quality, the price sensitive Indian consumer has stayed away from the high priced packaged foodstuff.

Another reason for poor processing is the high risk and low margins of this sector on account of seasonality, non-availability of raw material, high inventory carrying cost due to purchases at the time of abundance and the very high cost of packaging, i.e., around 40% of the estimates of product price. Lastly the issue of poor infrastructure, such as lack of integrated cold chain, roads, power etc., has also hampered processing.

There is need to aim at increasing food processing from a low of 2% as at present to 10% by 2010. This would entail an investment of Rs. 1,40,000 crore in the Food Processing Sector. The investment would generate direct employment for about 77 lakh persons and indirect employment for about 3 crore. This would also reduce wastages by about Rs. 8000 crore. Apart from these advantages the value addition of food products will go up from 7% to 35% which will be reflected in corresponding increases in GNP. The thrust will, therefore, have to be to attract foreign and domestic investments and generate internal accruals of above said magnitude. It is relevant to note that in the first few years after 1991-92 when the industry was de-licensed and major impediment on FDI were removed, a total investment of Rs. 7200 crore was committed. This trend was reversed only when excise duty was first introduced in 1997-98.

**The employment generation potential of this sector is much higher than other sectors, i.e., 54,000 persons get direct employment per 1000 crore of investment in the food sector in comparison to 48000 in textiles and 25000 in paper industry.**

The existence of multifarious laws and multiple authorities is a major hurdle. Many of these laws were framed some 50 years ago like Prevention of Food Adulteration Act and were meant to serve the purpose of food safety and to prevent adulteration. Similarly, many of the statutory orders like Fruit Products Order, Meat and Meat Products Order and Milk and Milk Products Order were brought into being under the Essential Commodities Act when there was acute scarcity of food items. In the context of liberalisation these laws throttle development and invariably work as dampeners for the growth of the industry. There is, therefore, an acute need for harmonising the existing food laws and to bring about a development orientation to facilitate faster growth of the industry.

This approach would bring about corporate entities operating large integrated food procurement cum distribution companies, which operate from the farm to the department store. In this changed scenario the small scale industries which constitute the majority of the food processing industries need to be adequately protected. In order to provide adequate protection and help them, the industrial corporates as delineated above will have to become anchors to assist and nurture them. Besides these anchor industrial corporates a number of food parks could be established so as to provide adequate help in adhering to international standards by means of establishment of common facilities. The chosen/anchor industries will help them to market the primary and secondary level of processed items and to convert them into value added products for sale through their different network of distribution channels including export.

In the short term by means of bringing about a tax holiday for the food processing sector for a period of 10 years a proper enabling environment can be created for bringing in adequate investments both from within the country and through foreign direct investment. Such a tax holiday need not cover tobacco,

*(Contd. on Page 40)*

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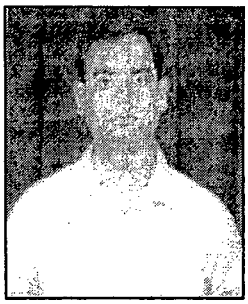

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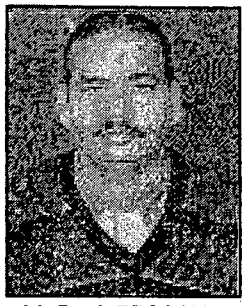

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# Crop Insurance and National Agriculture Policy

**Surinder Sud**

***While the success of the small area crop estimation approach would help remove a critical hurdle, other impediments still remain before a practical crop insurance scheme could be put in place to cover the risks involved in farming.***

WITH THE PRODUCER having least control over the production and marketing factors, agriculture remains one of the riskiest economic ventures. It is not only an entirely outdoor activity, open to ravages of weather, but is also exposed to damage by innumerable other factors such as pests, diseases, birds, stray animals, and artificial and natural calamities like floods, droughts, cyclones, fires, etc. Provision of an effective insurance cover for an activity of this nature is indeed not an easy job. The insurance companies that have decades of experience in providing the insurance cover to industries and other forms of business are disinclined to take up agricultural insurance business because of the much higher risk.

The National Agriculture Policy adequately appreciates the hazardous nature of farming and promises to offer suitable risk cover. It minces no words in conceding that "despite technological and economic advancements, the condition of farmers continues to be unstable due to natural calamities and price fluctuations".

The policy states that the National Agriculture Insurance Scheme (NAIS), covering all farmers and all crops throughout the country will be made more farmer specific and effective. It will be provided with built-in provisions for insulating farmers from financial distress caused by natural disasters and for making agriculture financially viable.

The policy, of course, talks about various other measures to reduce risk and impart greater resilience to agriculture as well. These include flood-proofing, drought-proofing, watershed development, drought-prone area development, price support through market intervention and futures trading for stabilising prices an hedging risks. However, insurance remains one of the most effective tools to compensate the farmer for their losses due to reasons and circumstances beyond their control.

'Barring two developed economies—the US and the UK—no other country has agencies dealing in crop insurance. India has been the first country in the developing world to endeavour to provide this facility to the agriculturists. However, a good deal of experimentation has gone into the business of crop insurance ever since it was first attempted in the country in 1985.

The successive governments at the Centre have been revising the crop insurance scheme and giving it different names, such as comprehensive crop insurance scheme, modified crop insurance scheme, modified comprehensive crop insurance scheme, experimental crop insurance scheme, etc. The whole exercise has been aimed essentially at evolving a model that is economically viable, administratively implementable and, above all, capable of suitably safeguarding the interests of the farmers. But these objectives have so far remained elusive.

The latest scheme called Rashtriya Krishi Bima Yojana or National

Mr Surinder Sud is Agriculture Editor, Business Standard.

Agriculture Insurance Scheme, launched on 22 June, 1999, and implemented from the Rabi 1999 season had made a sincere attempt to learn from the experience. It was conceived after prolonged deliberations with the concerned ministries and agencies and studying a large number of suggested models. It was not supposed to be a mere crop insurance scheme but an agricultural insurance scheme which would ultimately cover the risk of all agro-based and agriculture-related rural economic ventures, such as animal husbandry, poultry, piggery, goatry, bee-keeping, etc.

The reasons for the failure of all the earlier crop insurance schemes are indeed not far to seek. They had some fundamental flaws besides being too narrow in their coverage to be of much benefit to the farmers. They covered only a limited number of crops—wheat, paddy, oilseeds, millets and pulses. The cash crops that actually require greater risk protection due to higher cultivation costs were left out. Besides, the coverage was restricted only to rainfed crops. These two provisions made the old scheme either out of bound or unattractive for the progressive farmers in agriculturally important regions of the country.

## Constricted

The scope of the earlier schemes were also severely constricted because they were applicable only to those small and marginal farmers who had taken loans from financial institutions like credit cooperatives, regional rural banks and commercial banks. The sum insured was limited to the actual amount of crop loan subjected to a ceiling of Rs. 10,000. This made it virtually the loan insurance scheme rather than the crop insurance scheme and that too only for a limited number of small and marginal cultivators. The compensation payable to the affected farmers had no direct relationship with the actual losses suffered by them. Essentially, these were loan insurance schemes rather than risk insurance. They took care of repayment of farmers' loans rather than compensating them for the crop loss that they suffered.

Moreover, the schemes were structured in such a way that they depended heavily on the government support. On their own strength, they were economically unviable as the premium rates were fixed arbitrarily without taking the ground realities into account. The premium for wheat, paddy and millets was fixed at two percent and for oilseeds and pulses one percent. Half the premium to be paid by the small and marginal farmers was subsidised equally by the Central and state governments. The indemnity claims were shared by the Centre and the concerned state government in the ratio of 2:1.

**'Barring two developed economies—the US and the UK—no other country has agencies dealing in crop insurance. India has been the first country in the developing world to endeavour to provide this facility to the agriculturists.**

As a result, till Kharif 1999, the government had to shell out more than Rs. 1900 crore as indemnity claims, against the premium income of a mere Rs. 403 crore. The extremely unfavourable premium to claims ratio of nearly 1:5 rendered the projects in financial mess. Most state governments found the economic burden too formidable to bear.

Some of the lacuna of the previous schemes were, however, sought to be removed in the revised crop insurance scheme introduced in 1997 under the name of the "experimental crop insurance scheme" by making it applicable to all small and marginal farmers, both loanees and non-loanees. But no attempt was made to improve the financial viability. In fact, to make things worse, the entire burden of bearing the insurance expenses was passed on to the government to be shared in the ratio of 8:2 by the Centre and states. Consequently, even the Centre found itself financially over-burdened. The scheme, consequently, had to be folded up after trying it out in just one cropping season.

## Bold Attempt

The Rashtriya Krishi Bima Yojana, however, made a bold attempt to address most of these problems. It seems to have paid particular attention to the financial viability aspect by resorting to determination of premium rates on actuarial basis taking the previous yield data into account. It also made the state equal partners in sharing the liabilities with the Centre on 1:1 basis. The administration charges of the scheme were also to be borne by the Centre and states in the ratio of 50:50.

The scheme was implemented by the General Insurance Corporation of India with the provision that an exclusive organisation called Bhartiya Krishi Bima Nigam would be formed subsequently for this purpose. It envisaged obtaining reinsurance cover, nationally or internationally, to ensure sustainability of the scheme.

To broaden the scope of the scheme, it was made accessible to all the farmers, irrespective of their size of holding. While the farmers taking crop production loans from financial institutions had to compulsorily take an insurance cover, the participation of the others was made optional. There was no limit on the total sum insured.

Also, all the crops were made eligible for the risk hedging under the NAIS scheme though to begin with it applied only to all the cereals, including coarse grains, all pulses and oilseeds and three cash crops—sugarcane, potato and cotton. It was supposed to be extended to the remaining commercial crops, including horticultural crops in three years.

The premium rates were fixed tentatively at between 1.5 and 3.5 per cent for different crops. The premium on the crops facing increased risk as kept higher than those exposed to fewer hazards like wheat and other Rabi crops in general. Initially, the growers had to pay a premium of 3.5 per cent for bajra and oilseeds, 2.5 per cent for other Kharif crops, 2.0 per cent for Rabi crops and 1.5 per cent for wheat crop. Ultimately, the premium rates would be decided on actuarial basis taking into account the yield data collected through crop cutting experiments.

To ensure economic sustainability of the scheme, the transition to the actuarial regime of premium was envisaged to be achieved in five years. In case the rates worked out on the basis of actuarial data were less than the prescribed rates, the lower rate will be applicable. In the case of commercial and horticultural crops, actuarial rates were proposed to be changed from the inception of the scheme. Though the scheme proposes a 50 per cent subsidy on the premium for the small and marginal farmers, it was proposed to be phased out in five years.

The scheme is proposed to be operated on the basis of area approach. All farmers of a defined area hit by a calamity were entitled to payment of insurance claim according to the indemnity rates for the area on the basis of the actual data on the average threshold yield level of the region. In the event of localised calamities, such as hailstorm, landslide, cyclones, floods, etc., individual claims of the affected farmers were to be entertained. The progressive farmers who usually manage to reap better harvests were given the option to insure for higher compensation by paying more premium. The settlement of the claims was the responsibility of the insurance agency which had to clear all cases before the beginning of the new cropping season.

## New Scheme

The features of the new scheme were so conceived as to bring down the ratio of premium to claims to a more manageable 1:1.4 or even lower. Moreover, turning a little wiser with experience, the government proposed to give freedom to the GIC's subsidiary company which would operate the scheme to alter or modify insurance charges depending upon the prevailing circumstances. The aim is to make the venture internally viable to be able to survive and serve the intended objective.

However, though technically still in operation, NAIS has also run into problems, forcing the government to consider suitable modifications. Some states and one union territory have opted to implement it. These are Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Himachal Pradesh, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Tamil Nadu, Uttar Pradesh, Pondicherry and Andaman and Nicobar Islands. Many states, including some of those already participating in it, have expressed reservations on various provisions of the scheme. The main contentious issues include sharing of financial liabilities on account of indemnity claims, corpus fund and administrative expenses; the benchmark yield data for assessing damages, coverage of horticultural crops and the extent of area to be treated as the unit of insurance.

In the case of sharing of costs and liabilities, most states want the NAIS to revert back to 2:1 ratio, instead of 1:1. This would swell the Union government's liability substantially, especially in the initial years till the premium subsidies for small and marginal farmers are phased out. The *process* of consultations between the Centre and the states on this issue is already on.

Some states, notably Gujarat, have expressed reservation over the provision in the NAIS to allow farmers to insure their crop beyond the value of the threshold yield, upto 150 per cent of the average yield of notified area, on payment of premium at commercial rates. Considering that in the event of total crop failure in a particular season, the financial burden on the Union and state governments would be substantial, the state wants Rs. 50,000 to be the upper limit of sum insured.

There also seem to be problems about the coverage of perennial crops, such as apple, mango, coconut, and other horticultural crops which are grown widely in states like Himachal Pradesh and Kerala. While in the case of annual crops what is lost due to crop damage is the yield of that season alone, in perennial crops, it can be loss in yield as well as loss to plants affecting future yield as well. The assessment of such damage is far more difficult than that of crops, especially because productivity of plantations differ widely, depending on the age of the plantation plan variety and other factors. The solution to this problem lies, indeed, in building up adequate data base for assessing the damage.

The most tricky of all the problems that beset NAIS is the estimation of threshold crop yield data which would

form the basis for computing crop loss. Since the scheme envisages Gram Panchayat as a unit of insurance, it requires such data base to be built at that level. A minimum of eight crop cutting experiments in each Panchayat area have been prescribed under the scheme to collect this data over a period of three year. This provision is deemed too costly to implement. Besides, many states have said they do not have the necessary manpower and infrastructure to conduct such a large number of crop cutting experiments to collect average crop yield data. At present about five lakh crop cutting experiments are undertaken *in the* country under the general crop estimation survey system. Even this is considered to be a difficult burden to bear. The proposed system would require nearly 74 lakh crop cutting experiments to be done in the 16 participating states itself. This is deemed practically and financially nonfeasible.

A relatively cheaper alternative to this proposal has been worked out by the technical experts of the New Delhi based Indian Agricultural Statistics Research Institute (IASRI). Called "small area crop estimation approach", the suggested formula enables scaling down of existing crop estimation survey data to small area level through the use of additional information obtained from various sources. The IASRI has suggested that this approach could be tried out on a pilot basis before adopting it on the mass scale. The Union government has accepted this recommendation and the pilot project trials, at least in one district in each of the participating state, are likely to begin from Rabi 2000.

While the success of this formula would help remove this crucial hurdle, the other impediments still remain to be dislodged before a practical crop insurance scheme could be put in place to cover the risks involved in farming.❐

## *FOOD PROCESSING ...*

*(Contd. from Page 35)*

aerated drinks, Indian made foreign liquor and plantation items. The enactment of Processed Food Development Act and measures for generic promotion can also be done by means of market intelligence. The attempt during the short term period of say the next 3 years should be to develop a strong data base and a market intelligence network. Besides, certain special provisions will also have to be made for development of North-Eastern region, hilly areas, islands, ITDP, desert areas and other difficult areas.

In the medium term of 5 to 10 years the policy framework should attempt to establish a network of R & D institutions. Identification of anchor industrial corporates and development of food parks in all the states with reference to their regional strengths could be achieved during this period. Appropriate policies and schemes could be envisaged for establishment of cold chain and developmental related infrastructure, development and transfer of new technologies and product specific packaging, development of appropriate processable varieties of raw material, bringing about future's trading and equalisation funds as well as establishment of network of institutions and testing laboratories to achieve international standards so as to make Indian products export-worthy. There is need to propagate non-polluting, cheap technologies e.g. irradiation and biotechnology for preservation of food.

One of the key resultants of the policy is the Food Processing Development Act. The proposed Act envisages a single authority for harmonising and clarifying the function of each player. The department of FPI will have the role of development while food safety, distribution and other regulatory functions will continue to be administered under existing legislations. The Act would have a developmental focus rather than regulatory nature of the present enactments. The emphasis will be on development of the FP Sector as a whole, the concept of merit goods and encouragement to industries producing merit goods, equalization fund and futures trading for price stability and the need to take cognisance of genetically modified goods, and government response to them. The policies and guidelines in FP Sector be they relate to HRD, R&D, taxation or regulations also need to be addressed holistically.

In conclusion, it can be said that while the current level of food processing may reflect the primitive rural marketing structure, improvements in this sector can bring out vast improvements in value addition in agricultural products, creation of new employment, especially in the small towns and rural areas, improvement in the nutritional status of the rural women and the poor and availability of cheaper and better products for the consumers. World wide, the food processing industries are considered sunrise industries and have the potential of attracting huge local and foreign investments. These investments will not only accelerate the pace of industrialization, but will also lead to improvements in both rural and urban infrastructure. A well run food processing industry ensures that the producer gets remunerative prices for his product, the consumer pays less for higher and assured quality. The price to be paid in the shape of tax holiday, may no doubt, mean a few crores of loss to the exchequer, but that will be more than amply compensated by the additional investment inflows as also by long term gains to the government's fiscal resources. ❐

# Seed Development and Intellectual Property Rights

**S. Prakash Tiwari**

***One of the most vital keys to success in our endeavour towards agricultural sustainability in the country is to build up a globally competent seed industry in the country. The post-GATT scenario calls for preparedness especially in terms of global competitiveness and protection of intellectural property rights.***

SEED IS THE BASIC unit of crop production through which other inputs manifest. It also serves as a catalyst for making other components of production technology effective. Presently seed sector is beset with new emerging post-GATT trends like Intellectual Property Rights (IPR).

An increase in the availability of new improved varieties in the country provided a stimulus to the development of formal seed production and distribution systems. Both public and private sectors are now involved in the process of seed production and distribution.

At present the Indian seed industry consists of two national organizations—13 state seeds corporations, about 147 private seed companies, 19 state seed certification agencies and 63 notified seed testing laboratories. Several private seed companies are multi-national and have their own R&D. Public sector produces bulk of self-pollinated crops, of which wheat and rice account for 60% while private sector deals mostly on hybrids, vegetables and flowers accounting for about 50% of total production of certified seed in India. The basic reason for private companies focussing on these crops is that they involve low volumes and high returns.

Dr S. Prakash Tiwari is Director, National Research Centre for Soyabean, (ICAR), Indore.

Global commercial seed market is estimated to be worth more than US $ 15 billion. Hybrid seed sales in various crops account for nearly 40 percent of seed market. Availability of both the breeder seed and quality/ certified seed for farmers has experienced a steady increase over years. Breeder seed production is the mandate of Indian Council of Agricultural Research (ICAR), which is being undertaken, with the help of ICAR Research Institutes, National Research Centres and All India Coordinated Research Projects concerning different crops and state agricultural universities. Of late, ICAR has encouraged sponsored breeder seed production programme especially through State Farm Corporation of India, state seed corporations and even Krishi Vigyan Kendars and NGOs which combinedly have substantial farm and related infrastructure in the country. Breeder seed produced for different crops has recently surpassed the figure of 29,000 quintals annually. About 700,000 tonnes of quality seed is distributed every year out of which about 560,000 tonnes is certified seed.

The vertical Seed Replacement Rate (SRR) realised in the country needs improvement. For major crops like wheat and rice, the SRR is about 9 and 14 percent at present. It is, however, to be noted that even in a country like USA, 50 to 70% of the seed used in case of several self-pollinated crops is farm-saved seed. In crops where hybrids are available, the SRR should be 100%, which is not yet achieved. The maximum SRR in hybrids crops is in bajra, which is about 50%. This needs to be extended to other crops like maize, especially in the northern region. Pulses in general and chickpea in particular have abysmally low replacement rates. There is an urgent need to increase the quantity of seed produced so that SRR may increase to a

satisfactory level.

Easy availability of planting material and minimizing the time lag between release and adoption by farmers is yet to be achieved in real sense. It is, hence, axiomatic that all echelons involved in the process facilitate seed availability, as seed is a basic input to agriculture, which also serves as a catalyst for making other agro-inputs productive and cost-effective.

## Vegetable Seeds

The vegetable seed industry in India started with a few British owned companies like Sutton & Sons, at Calcutta and Pestonjee P. Pocha from Pune. During late 60's, a few private seed companies especially those based at Jalana started multiplying the seeds of virus tolerant Pusa Sawani Bhindi (lady's finger). Another private company at Bangalore launched hybrid technology in flower and vegetable crops. With liberalization especially under the New Policy on Seed Development (1988) more companies including multinationals came in.

Vegetable seeds are of low volume and high value type. It is estimated that vegetable seed constitute about 3% in volume and 23% in value of the total seed market of the country. It is estimated (1995) that India's annual requirement of vegetables seeds would be of the order of 35,500 tonnes. The crop wise estimates show that the share of hybrids is significant.

The release of the first four hybrids of maize in 1961 necessitated the creation of a separate organization for seed production in order to exploit the full production potential of these hybrids. This necessity led to the conception of the idea of Central Seeds Corporation in 1963 which led to the formation of National Seeds Corporation (NSC) Limited in 1963. The official varietal release system was started in October, 1964 with the formation of Central Variety Release Committee (CVRC) in the ICAR at the national level and the State Variety Release Committees (SVRCs) at state level. The Seeds Act was enacted by Parliament in 1966. The Seed Rules were notified in 1968. Seed was declared an essential commodity under the Essential Commodities Act (1955). After 1969, the functions of the CVRC were taken over by the Central Seed Committee and its constituents, the Central Sub-Committee on Crop Standard, Notification and Release of Varieties and also state sub-committees established under the provisions of the Seeds Act. As per the need, amendments were made in the Seeds Act from time to time, i.e. in 1972, 1973, 1974 and 1981. Notification of kinds or varieties, as provided for in the Seeds Act, was started in 1969.

Varieties can be released after testing for cultivation and use and eventual identification under the All India Coordinated Crop Improvement both at the Central and state levels but notifications is carried out only by the Crop Standard, Notification and Release of Varieties with Deputy Director General (Crop Sciences) of ICAR as its Chairperson. The Indian system of All Indian Coordinated Trials for varietal and technology testing is one of the unique and most complex in the world and has been appreciated and discussed globally. A Centre Seed Laboratory at New Delhi and State Seed Laboratory at state level were established or designated. The Seed (Control) Order was issued in December 1983, which makes it obligatory for seed traders to obtain a licence. The Plants, Fruits and Seeds (Regulation of Import into India) Order was issued on 27 October 1989. A New Policy on Seed Development (NPSD) was evolved which came into force from September 1988 with special emphasis on the following areas :

(i) Import of high quality seeds

(ii) A time-bound programme to strengthen/modernize plant quarantine facilities

(iii) Effective observance of procedures for quarantine/ post-entry quarantine

(iv) Incentives to encourage the domestic seed industry

It was envisaged that the NPSD (1988) would help the seed industry to grow and getting access to the best available seed and planting material available anywhere in the world will benefit the farmers. The policy has been in vogue since then to fulfil these objectives. The Seed Policy along with the NPSD is currently being revised with the changing national and global scenario. The Plant Variety Protection Act is also on the anvil to fulfil the obligations provided under the article 27.3(b) of TRIPS.

## New Seed Policy

The Seed Policy Group under the chairmanship of Dr M.V. Rao has recommended the following in regard to plant breeders rights.

(i) Seed Policy should address basic issues related to introduction of new varieties in the country, seed production and distribution and quality control. It should provide a framework for seed planning.

(ii) Seed Policy should :

(a) provide a framework for introduction of Plant Breeders' Rights (PBRs) in the country

(b) provide a basis for planning seed production and distribution

(c) decide the relative roles of the public sector, private sector and their interface with the research system

(d) set the parameters for quality

control and seed legislation, and

(e) provide guidelines for interventions which affect the price of seeds.

(iii) As a signatory to the Agreement on Trade Related Intellectural Property Rights (TRIPs), India is expected to enact a legislation for plant variety protection. But independently of this obligation, there are strong reasons for providing for plant variety protection as under :

(a) To promote/protect large private sector investment in plant breeding by providing appropriate returns on such investments.

(b) To facilitate access for Indian farmers and the seed industry to improved varieties protected in other countries.

(c) To encourage need based, appropriate research for development of varieties that are suited to the relevant agro-climatic conditions.

(d) To enable Indian breeders to get protection for their varieties in other countries on the principle of reciprocity.

(e) To facilitate market access for export of seeds to countries having a system of plant breeders' rights.

(f) To ensure researchers' access to foreign germplasm in future.

(iv) If the objective of seed Policy is to make available the best seeds or planting material available anywhere in the world to Indian farmers, then a system of plant variety protection is essential.

(v) The PVP legislation should be drawn up in conformity with the provisions of the UPOV 1978 Convention. It should provide for the traditional rights of farmers to save, use, exchange, share or sell their produce of the protected varieties. It must also provide for compulsory licensing in public interest.

(vi) The preparatory work required for implementing a PVP legislation in terms of establishing the administrative infrastructure, of DUS testing facilities etc. should be undertaken well in advance of the enactment of the legislation.

(vii) Varieties which are granted protection under the PVP legislation should be deemed to have been registered under the provisions for compulsory registration of all varieties suggested.

(viii) The public research system should work out appropriate guidelines for sharing the economic returns from a protected variety between the breeder and his institution.

(ix) India should accede to the UPOV 1978 Convention.

(x) A decision has been taken to have a *suieneris* legislation for plant variety protection. This provides a framework for Plant Breeders Rights balanced by farmers rights and other.

(xi) The proposed PVP legislation has been in conformity with the provision of the UPOV 1978 Convention.

(xii) A scheme has been proposed for implementation of the legislation on plant variety protection.

The recommendations have been largely accepted.

## Post-GATT Scenario

The General Agreement on Tariffs and Trade (GATT) came as a means of stimulating world trade in the post World War II situation. The main concept was to remove impediments to trade through (i) "national" treatment (Article III), (ii) general "most-favoured-nation" treatment (Article I) and (iii) preferential treatment for developing countries. Access to market, domestic subsidies, export etc. are to be regulated as per the internationally agreed terms under GATT. Schedule for replacing quotas and tariff rates along with definitions of key concepts like 'dumping', and clarification of allowable extent of unilateral responses (countervailing duties, protection of balance of payment etc.).

Since 1945 and up to 1994 i.e. for seven rounds GATT dealt with tangible goods with emphasis on tariffication and reduction and gradual diversification of all barriers to tariffs. It was with the Uruguay Round in 1994 that following four major initiatives extended the scope to include non-tangible goods.

(i) Trade in services and technologies

(ii) Agriculture

(iii) Environment

(iv) Intellectual Property Rights

### Trade-related Aspects of Intellectual Property Rights (TRIPS)—Plant Variety Protection

As a signatory to WTO Agreement, India is committed to enact law to protect plant varieties under Article 27(3)(b) of the Agreement on Trade-related Aspects of IPRs (TRIPS). The TRIPS defines patentable subject and requires inter alia that member countries shall provide for protection of plant varieties. Patent shall be available for any inventions, whether products or processes in all fields of technology provided that they are new, involve an inventive step and are capable of industrial application.

Article 27(3)(b) of the (TRIPS) states that "Parties shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof. This provision shall be reviewed four years after the entry into force of the Agreement establishing the WTO (the World Trade Organization)". India is poised to meet this requirement through a *sui generis* system for the protection of plant varieties.

UPOV (the French acronym for 'Union Internationale Pour La Protection Des Obtentions vegetables' i.e. 'International Convention for the Protection of New varieties of Plants') is an intergovernmental organisation which cooperates in administrative matters with the World Intellectual Property Organisation (WIPO) and has its headquarters in Geneva, Switzerland. Presently UPOV has about 40 member states.

## Forms of IPR

There are several forms of IPRs such as patents, Plant Breeders' Rights (PBRs), copyrights, trade secrets, trademarks, MTAs/ Contracts and undisclosed information/know-how.

Patents protect generic inventions, must be new, non-obvious products or processes, need not actually physically exist and less than 1 in 10 patents are exploited commercially. IPR is needed to encourage innovation. It allows recovery of investment (sunk cost) and is particularly necessary where products are self-reproducing.

### Indian *sui generis* system for plant variety protection

The main objective of the proposed legislation is to give a significant thrust to agriculture growth by providing an effective system for protection of plant varieties. While providing for an effective system of protection of Plant Breeder's Rights, the proposed legislation also seeks to safeguard farmers' and researchers' rights. Farmers' rights to use farm saved seed are protected.

## Distinct Denomination

The proposed law will be known as the Plant Varieties and Farmers' Rights Protection Act. A variety shall be registered for protection only if it conforms to the criteria of novelty, distinctness, uniformity and stability (DUS). Every breeder seeking protection of his new variety shall give a clear cut single and distinct denomination to his variety for identification. Only varieties of such genera/species as are notified for this purpose by the Central Government from time to time will be given protection. No registration of a variety shall be made under this Act in cases :

(a) where prevention of commercial exploitation of such variety is necessary to protect public order or public morality of human, animal and plant life and health or to avoid serious prejudice to the environment. Having regard to public interest, the Central Government may also denotify genera or species.

(b) all seed/planting materials of any varieties or species which contains "Terminator Gene" that affects seed in such a manner that it would not germinate if replanted at second time.

Any new variety which is essentially derived from any other protected new variety (initial variety) may be registered for protection by the Authority if it fulfils the specified criteria for protection. The breeder of the essentially derived variety may exercise the rights, subject to an authorization from the breeder of the initial variety.

Period of protection of new variety of plant shall be fifteen years in all cases except in case of trees and vines where it shall be eighteen years from the date of registration of new variety.

Any breeder who has duly filed an application for protection in a convention country (or in a country with which India has reciprocal arrangements), shall enjoy a right or priority for a period of 12 months for the purpose of filing an application in India. This period shall be computed from the date of filing the first application. The day of filing shall not be included in such period.

There will be a Varieties and Farmers' Rights Protection Authority to exercise following functions :

(a) Characterization and documentation of plant varieties;

(b) Registration and protection of extant and new plant varieties;

(c) Ensuring access of researchers to protected varieties for bonafide research;

(d) Protecting farmers' rights in accordance with the provisions of this Act

(e) Ensuring equitable sharing of benefits arising out of the use of plant genetic resources

(f) Formulating regulations for discharging its functions

There shall be a Plant Varieties Registry in the Authority for facilitating the registration of plant varieties.

## Equitable Sharing

A provision has been made for equitable sharing of benefits arising out of the use of plant genetic resources indigenously developed or preserved by governmental institution, non-governmental institutions, private companies or individual plant breeder that may

accrue to a breeder of new variety from the sale, disposal etc. of seeds/ planting material of new varieties. The proceeds of the benefit sharing arrangement will be deposited in the National Gene Fund. It is envisaged that the PVP Authority would determine the royalty sum to be paid by the breeder of a new variety either on a one time or recurrent basis. The PVP Authority will decide on merit of each case the quantum of payment to be awarded from Gene Fund to the original developer/preserver of the genetic resources.

Nothing shall affect the farmer's traditional rights to save, use, exchange, share and sell his farm produce of the protected variety except sale for reproductive purpose under commercial marketing arrangements.

## Compensation

The farmers rights also include the rights arising from the past, present and future efforts of farming community in conserving, improving and making available plant Genetic Resources. Thus, the arrangements have been made for providing compensation to the farmers/group of farmers/cluster of people of the village for their significant contribution in evolution of a plant variety or a propagating material which has been granted protection under this Act. Such compensation would be given to the farming community/village community from the National Gene Fund after collecting contributions in Gene Funds from the breeder of that variety or planting material.

Researchers shall have free and complete access to the protected varieties for bonafide research and for development of new varieties of plants. Researches will not require any authorization of the breeders for the aforesaid use of new varieties.

A National Gene Fund shall be established. The Fund shall be utilized for the share of individual/ groups of individual/NGOs in the benefit sharing arrangements, compensation to village communities and maintenance, conservation, preservation etc. of plant genetic resources and varietal development activities.

The Authority may resort to compulsory licensing of a protected variety in public interest. The grounds on which compulsory licensing may be resorted shall include the following :

a) that requirements of public for seeds and propagating material of a variety are not being met;

b) that the production of the seeds of planting material of the protected variety is not being facilitated to the fullest extent that is reasonably possible without undue delay.

**Nothing shall affect the farmer's traditional rights to save, use, exchange, share and sell his farm produce of the protected variety except sale for reproductive purpose under commercial marketing arrangements.**

Civil remedy, penal provisions and conformity to other legislation have also been include in the proposed act.

The Indian bill is to be called "Plant Variety and Farmers" Rights Protection Bill". The main features of the proposed Legislation are that farmers' rights and researchers' rights have been protected. In fact Farmers rights will be an integral part of the legislation. The concept of equitable benefit sharing and village communities rights will also be covered in the proposed legislation. The legislation will also recognize the role of farmers and farming communities in conservation and maintenance of agro-biodiversity. The proposed legislation also seeks establishment of a National Gene Fund to provide compensation to the village community for on farm conservation of old and traditional varieties, arrangements for benefit sharing and assistance for conservation and preservation of plant genetic resources.

## Farmers' Rights

Farmers' rights pertain to farm saved seed, traditional varieties and knowledge and several related activities. In the Indian *sui generis* system it is proposed that the protection to a variety will be given subject to it's conforming to distinctness, uniformity and stability (DUS). An authority at national level has been proposed to lay down procedures for the conduct of PVP and for smooth functioning of the system. A registry is proposed to be in place in the authority for facilitating the registration of plant varieties along with provision of branch officers.

A compulsory licensing system has been proposed so that proprietor of a plant variety may not hold it and its multiplication and distribution are ensured in public interest. Issues of extant varieties and essentially derived varieties have also been spelt out. An Appellate Board, civil remedies including penal provisions and conformity to other laws have also been ensured. Provisions for tribunal, infringement offences and penalties have also been made. It is to be noted that flowers and ornamentals claim a major share of plant variety protection titles issued followed by vegetables, fruit tree, mushrooms etc. Ornamentals and

trees crops may take more seasons. For ornamentals, breeders are expected to send photographs also. It is impossible to grow all reference varieties in case of ornamentals like roses. Hence, a team of experts is also needed to decide upon distinctness and still the clearance of DUS, although given, may be nullified if new claim is made regarding its distinctness.

## Revised Seeds Act, 2000

The Seed Policy Review Group in its recent report to the GOI has strongly recommended inclusion of the provision of IPRs for protection not only in the "Plant Variety and farmers' Rights Protection Bill" but also in the Seeds Act. SPRG has expressed its concern that a very large proportion of seed marketed in the country is out of the purview of the seed legislation. The Act will encompass horticulture and agriculture. It proposes to provide regulation of sale, import and export of seeds and also facilitate the supply of quality seeds to the farmers throughout the country. There is a provision for the establishment of a National Seed Board (NSB). The proposed NSB shall advice the Central and state governments on all matters related to seed programmes, planning, development, production, registration, maintenance of National Register of Varieties, determination of quality parameters and criteria for registration, accredition of seed legislation and its enforcement, export and import of seeds, conduct of value for cultivation and use (VCU) test or any other test for the purpose of registration.

Two of the most important aspects of this act are the registration of seed and the exemption clause. Registration will be based on VCU whereas testing under the plant variety protection legislation is based on DUS. The testing for VCU will thus take into purview the farmers' interests. Further, the section 29 relating to the 'Exemption Clause' which states "Nothing in this Act shall apply to any seed of any registered kind or variety grown by a farmer and sold or delivered by him on his own premises or in the local market direct to another farmer for being used by that farmer for the purpose of sowing or planting". This clause protects the farmers from being exploited by multi-national companies and gives him the right to produce, use and sell his own seed. The Seed Act also proposes to substantially enhance the penalties on the defaulting parties.

IPR has become a more complex issue especially in regard to transgenics or genetically modified organisms. A transgenic may involve several, at least more than one, proprietary components/protections. It may not be possible to buy the rights for all. It will, then, call for agreements with the owners of these components.

## Concern

Concern have been expressed in regard to genetically modified organisms (GMOs) vis-a-vis biodiversity in Article 19.3 of the Convention on Biological Diversity on the "Handling of Biotechnology and Distribution of its Benefit". Country like India, which is rich in biodiversity, has to take special measures to safeguard the biodiversity while resorting to GMOs for high productivity and quality of crops.

Our country has a large number of small farmers who use farm-saved seeds. This calls for a caution in resorting to the technology like "terminator gene" which is a patent i.e. "Control of plant gene expression", US Patent No.5,723,765 taken by the Delta and Pine Land Co. and the USDA for controlling the viability of progeny seed without harming the crop. The GOI has already taken steps not to allow this technologies in the country.

Act 22 under Sec. 3 of Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) provides for "Geographical indications". A Geographical Appellation Act would safeguard area specific products like the basmati rice grain, Darjeeling tea, Dashahari mango etc. in much the same way the term "Champagne" is reserved for a product from a particular region in France. The country has now brought in a legislation to protect geographical indications.

## Conclusion

Easy and timely availability of good quality, pure seed of the desired variety in required quantities is the quickest way of increasing agricultural production through coverage of larger acerages under high yielding varieties, assured plant stands and healthy crops leading to bumper harvests. One of the most vital keys to success in our endeavour towards agricultural sustainability in the country is to build up a globally competent seed industry in the country. The post-GATT scenario calls for preparedness especially in terms of global competitiveness and protection of intellectual property rights. The plant variety protection as well as the revised seed act of the country are on the anvil. Provisions of these will greatly effect the seed industry. While ensuring the investment and its return in variety development and seed production, these regulatory measures have strong provisions to safeguard farmers' interests. With its diversity of natural and human resources, the Indian seed scenario is bound to attain further heights for meeting the larger goal of safeguarding Indian farmers' interests and also for providing household food and nutritional security in the country. ❐

# Women Empowerment in Farm Sector

**B.S. Padmanabhan**

***The need for empowering rural women in agriculture through effective training and extension services arises from the gradual decrease in the availability of arable land, increasing population pressure and growing environmental degradation which have far reaching implications for food and nutritional security in future.***

INAUGURATING A conference of Commonwealth Ministers in charge of Women's Affairs last April in New Delhi the Prime Minister Mr. Atal Behari Vajpayee had observed that political empowerment of women alone would not do; along with it should come social and economic empowerment. The Union Minister for Human Resource Development Dr. Murli Manohar Joshi had not only announced on that occasion that a National Policy on Empowerment of Women was being finalised but also declared that the year 2001 would be observed as "Year of Women Empowerment".

This recognition of the need to empower women in all sectors has not come a day too soon. Out of 146 countries, India ranked 118th in the Human Development Index in 1997 and similarly in the Gender-Related Index too it ranked 118th. This illustrates the aggravation of the human development gap by gender disparities. A significant initiative for political empowerment was taken seven years ago through the 73rd and 74th Constitutional Amendments, which provided for reservation of one-third of seats for women in the local bodies. As an extension of this initiative a Bill to provide for similar reservation in state and Central legislatures had been mooted. As regards socio-economic empowerment a beginning was made in the Ninth Plan to earmark a share for women development in the allocations for these sectors. One has to wait for these measures to make any visible impact.

There can be no two views on the need to free women from gender-related shackles, build up their capacity, empower them with information and knowledge and allow them to emerge as leaders with confidence to guide their own destinies. This is relevant all the more in agriculture and allied sectors. Agriculture in India, which contributes about one-third to the country's national income, is increasingly becoming a female activity. According to official estimates, one-third of agriculture labour force and nearly half of self-employed farmers are women. Of the total female workforce in rural areas 89.5 per cent are employed in agriculture and allied industrial sectors.

An FAO Fact Sheet on "Women in Agriculture, Environment and Rural Production" has noted that the nature and extent of their involvement in agricultural activities differ according to the variations in agro-production systems. The mode of female participation in agricultural production has been found to vary with the land-owning status of farm households. Their roles range from managers to landless labourers. In overall, farm production women's average contribution is estimated at 55 per cent to 66 per cent of the total labour. The extent of their contribution can be gauged from the finding in a study that in the Himalayan region a pair of bullocks works 1064 hours, a man 1212 hours and a woman works 3485 hours a year on a one-hectare farm.

No simple gender division of labour is found to exist with regard to crop production. Depending on the region and crops, women's contributions vary but undoubtedly they play a pivotal role from planting

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to harvesting and even post-harvest operations. They are engaged in seed selection, seedling production, weeding and preparation of green and farmyard manure.

In animal husbandry there is an estimated 20 million women as compared to 1.5 million men and in the dairy sector there is an estimated 75 million women, as compared to 15 million men. In livestock management and milk production women perform a wide range of tasks, which include caring of animals, grazing, fodder collection, cleaning of animal sheds and dung composting, besides processing of milk and other livestock products. In the forestry sector studies have shown that women are the major gatherers and users of diverse range of forest products and that women collect primarily the non-timber forest products. These constitute the main source of livelihood for large proportions of the population in several parts of the country and include medicinal plants, material for house hold items and farm implements. In the area of fisheries women's participation varies across states. The main areas of their involvement include fish drying/ curing, marketing, mending nets and shrimp processing. Women are also found to play a key role in land use and management. Besides these, women's participation in agro-based rural industries has been quite significant. According to one estimate, women constitute 51 per cent of those employed in forest-based small-scale industries. They make baskets, brooms and ropes, besides rearing tassar silk cocoons, cultivating lac, etc.

One of the recent trends has been the migration of male labour to off-farm employment, which fetches higher income. As a result, one-third of the rural families, for all practical purposes, is headed by women. Rural India is thus witnessing a process, best described as "feminization of agriculture". As in other parts of the world, in India too feminization of agriculture brings with it "feminization of poverty", with all its consequences on the nutritional status of the family of the rural women. According to one study, women head 35 per cent of the households below the poverty line. As the Prime Minister has rightly noted, the phenomenon of "feminization of poverty" requires to be addressed seriously by policy-makers by studying the differential impact of development plans on women.

**As in other parts of the world, in India too, feminization of agriculture brings with it "feminization of poverty", with all its consequences on the nutritional status of the family of the rural women. The phenomenon of "feminization of poverty" requires to be addressed seriously by policy-makers by studying the differential impact of development plans on women.**

Despite their significant contribution to agricultural and agro-based rural production rural farm women usually are a neglected lot. The income they earn is not commensurate with the task they perform. The proportion of women in the agricultural labour force is steadily rising and is expected to cross the 50 per cent mark from the existing one-third soon. But the situation of women agricultural labour is both grim and pathetic. They toil day and night in the fields at wages lower than that paid to men. According to a study, women have a share of only 25.7 per cent in earned income. Their main problems are : long hours of heavy work; low productivity; limited access to new technology; restriction to low-paid jobs or unpaid family labour, lack of access to and control over resources like land, credit, water, marketing and management; gender-biased extension services and limited access to training; lack of support services to play the multiple roles expected of them; gender-biased wage differentials; occupational hazards to health.

Against this backdrop, one should welcome the new National Agriculture Policy in that it holds out promise of better days for rural women. Besides including "women empowerment" among the objectives, which would be the hallmark of the new policy, it has devoted a separate paragraph to highlight the commitment of the government to mainstream gender concerns in agriculture. The new policy promises to initiate appropriate structural, functional and institutional measures to empower women and build their capacities besides improving their access to inputs, technology and other farming resources. One expects an effective action plan to be formulated to achieve this.

As the FAO Fact Sheet points out, the focus should inter alia be on gender sensitive planning at the local Panchayat level, gender/sex segregated information to support local development efforts, development of regular curricula in all agricultural education institutions to integrate a gender approach in all technical areas of farm sector, review of land rights policies and implementation of land distribution to ensure gender equity and women's

land rights and explicit addressing of concerns of women farmers in farmers' rights initiatives. The programme focus should include training of panchayat leaders in gender-integrative participatory approaches and local planning, building leadership skills of rural women for managing agriculture community-based development activities, economic and development literacy courses for rural women to utilise effectively the development inputs, support to women-managed rural production and marketing ventures in horticulture, floriculture and post-harvest processing in commodities, and provision of technology training and input support to women to take advantage of the emerging high value-agribusiness sector.

The need for empowering rural women in agriculture through effective training and extension services arises from the gradual decrease in the availability of arable land, increasing population pressure and growing environmental degradation which have far reaching implications for food and nutritional security in future. Sustainable agricultural development will require access to inputs and new technologies on the one hand and training of farmers and extension services on the other.

Policy makers are increasingly aware of this and have launched innovative schemes for implementation not only through government agencies but also through dedicated non-governmental organisations. The Danish International Development Assistance (DANIDA) has been assisting the Government of India since early 1980s to initiate farm women-oriented extension programmes in four states, namely Karnataka, Tamil Nadu, Madhya Pradesh and Orissa. While the DANIDA project is implemented through government agencies, there are a number of NGOs working in this area. The Indian Council of Agricultural Research has set up a National Research Centre for Women at Bhuvaneswar to help rural women upgrade their skills and equip themselves for effective participation in the national endeavour to ensure food and nutritional security.

One of the constraints in reaching out to women is that in several states cultural restrictions prevent male extension officers from meeting with women farmers. Moreover, because of the very nature of their domestic responsibilities women do not find it convenient to attend meetings and training courses away from home. The number of female extension workers too is not adequate. In this context a variety of approaches are being adopted to reach women farmers. This includes the use of electronic media, field demonstrations, printed materials and study-visits to expose women farmers to success stories of other women farmers. It is also felt that the inter-personal contact approach should be supplemented by group contact approach. All these would call for a reorientation of the entire agricultural extension ethos.

**Experts in agricultural extension work have found women to be better communicator and feel that one-to-one oral communication through women will have a greater diffusion value.**

Experts in agricultural extension work have found women to be better communicators and feel that one-to-one oral communication through women will have a greater diffusion value. Hence, rural women with some traits of leadership can be approached for assisting in the extension work and they can contribute significantly to increasing farm productivity and production, besides generating employment in allied sectors. Unlike their male counterparts, women extension workers are found to have total commitment to work and stick to their jobs.

There are quite a few success stories for empowerment of rural women through training and extension activities. For instance, the Central Institute of Freshwater Aquaculture (CIFA) has, as part of its extension activities, cleaned and deepened the village pond in Siul (Orissa) and provided fish seed and technology to the women in that village. This has helped the women in that village get a rich harvest of fish and improve their earning. In Kumana village of Saran district of Bihar an NGO—Voluntary Action for Research Development and Networking—has successfully organised strong self-help groups of rural women. In this village there was a part-time lady who taught tailoring to the girls in the village at a cost which not many could afford. Her charges were high because she did not have the infrastructure to teach more than two or three at a time. Since there was a felt need for such a training in the village, the NGO set up a Tailoring Training-cum-Production Centre and persuaded the same lady teacher to take classes at the new centre with more sewing machines and two assistants on reduced fees. As a result, more rural girls now have opportunities to get trained in tailoring. The project is focussed on women, particularly from small and marginal farm households. This project on Training and Extension for Women in Agriculture (TEWA) has as its key functionary the lady village agricultural worker (LVAW), who

plays an important role in motivating and influencing farm women.

This has triggered the setting up of a strong Mahila Mandal (Women Forum) and a few small self-help groups. Interactions among these groups have increased not only within the village but also in the panchayat, comprising five villages. Spurred by this conducive environment, the NGO has been organising the rural women for more meaningful roles in rural development by promoting the concept of "earn while you learn" and pursuing the process of "teaching by doing" and "learning by doing". The NGO's efforts have got a further boost with the government-owned NABARD approving a project to train 30 rural women for a period of 45 days by the NGO in garment-making, village crafts, and food processing.

A Pune-based voluntary research organization involved in sustainable management of natural resources and poverty alleviation—BAIF Development Research Foundation—trained a landless woman in a village in Pratapgarh District of Uttar Pradesh, in vermi-composting. Today she has not only started earning enough to sustain her family and send her children to school but also has been training other landless women in this income earning activity. Such composting activities help in improving crop production, where farmers have not been using farmyard manure in adequate dose or chemical fertilisers, besides reducing the environmental pollution as a lot of waste is recycled into the field.

**The need for empowering rural women in agriculture through effective training and extension services arises from the gradual decrease in the availability of arable land, increasing population pressure and growing environmental degradation which have far reaching implications for food and nutritional security in future.**

These success stories bring out how rural women can be empowered through training and extension services. However, for every woman thus rehabilitated there are still millions still toiling day and night without even one square meal a day in the rural areas. The woes of a small and subsistence farmer are indeed numerous and these arise from the very nature of the prevalent socio-economic environment. Apart from the inherent constriants to their access to credit, extension and training services, marketing of their produce etc., the structural adjustment policies initiated in recent years have only aggravated the situation, thanks to the consequential shift away from subsistence production to large-scale and commercial farming and reduction in government spending on market and price support to the small and subsistence farmers. Among them, the worst affected are women who have to bear the brunt more than men. One hopes that the NAP 2000 will set the pace for effective empowerment of women in agriculture and allied sectors in rural areas. ❐

# Diversifying Agriculture: The New "Mantra"

**Arabinda Ghose**

***A marriage between tradition and modern will ensure food and nutrition security for the nation for a long time to come and which should be the "mantra" during the early decades of the new millennium.***

SEVERAL YEARS AGO, this writer was a member of a press party which was taken to the Sunderban area of West Bengal by the Central Capture Fisheries Research Institute based at Barrackpore for a visit to a farmer's house in a remote village. We had to leave our cars on the bank of a river—which probably is a channel in the Ganga delta—crossed it by boat and then took what is popularly known in those parts as "rickshaw vans" for the last lap of our journey.

On arrival we were served green coconut water, after which we set forth to visit his farm, at one corner of which he has his homestead. What greeted us was a bewildering variety of crops he had planted on the nearly two hectares of land. There was of course the paddy field in one corner. Then we found one segment where potato was being cultivated. Another small plot was flashing ladies fingers and a smaller one had the "natey shaak" (a leafy vegetable), while adjacent to it was a plot on which lemon, chillies and ginger were being raised.

The mandatory banana plants were yielding green bananas to be used for cooking vegetables, with a few papaya trees giving this portion company. In fact, "you ask for it and it was there" type of story could be written about this plot of land.

This plot was surrounded on two sides by a pond in which one could see the sparkling "rohu" fish (Labeo rohita) and other fishes. The farmer was contemplating taking up prawn (Machrobracium rosenbergii) cultivation and that was the reason for the visit being arranged by the fisheries institute, under the Indian Council of Agricultural Research (ICAR) which had been doing pioneering work on induced breeding of fishes, mainly the carps such as rohu.

The Sunderbans are an isolated area. Only recently has a railway line reached Kakdwip and it will be taken to Namkhana, further south, soon. While foodgrains and other crops give the people some sort of food security, they have to go out to Calcutta, about a hundred kilmetres to the north, for many of their needs or at least upto the sub-divisional town of Diamond Harbour. During cyclones or floods, it is difficult to leave home and lakhs of people in the area forego many of the normal food.

Luckily, our farmer did not have those problems, because he grew almost every edible article in his field.

Why I am recalling this story is that increasingly, modern agriculture in India is nearing towards mono-crop or at the most only double-crop system. In rainfed areas, it is either paddy alone during kharif, with only some minor crops taken during the dry rabi months. In the irrigated areas where green revolution is still in vogue, the rice-wheat cycle appears to be set for a long innings.

But then how long would that innings last ? If the plight of farmers of Punjab, Haryana and Western Uttar Pradesh these days is taken into account, one will find that the lucrative business of growing enormous volumes of both paddy and wheat is now wearing thin. With the Food Corporation of India (FCI)

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godowns still full to be brim after the bumper wheat harvest of Rabi 1999-2000, there is just no space left for storing the paddy which has started coming into the market since the third week of September. The Union Government now is being more or less forced to buy paddy from the farmers, of which there is no need at present, from Punjab, Haryana and Western Uttar Pradesh. The Rabi wheat has already been sown or it being sown, and heaven only knows how the FCI will deal with the situation if another bumper wheat crop is harvested in April—May 2001.

With stocks rising upto 40 million tonnes now, the government is as baffled as the farmers about how to deal with the situation. It is true that close to 30 crore people in the country live below the poverty line as of now and they would jolly well be provided this surplus grain at nominal prices or, as some people suggest, absolutely free. The justifiability of taking recourse to this path for reducing stocks with the FCI is still being debated.

But then, why do farmers in the three green revolution areas continue with the rice-wheat cropping pattern even now ? According to one version, economics plays a vital role in this seemingly illogical system. By the time the wheat crop is harvested, it is already May. The harvesting in north-west India is done by farm labour coming from Bihar, Eastern Uttar Pradesh and some other areas. If the paddy crop is to be taken up from the "normal" time of July in north-west India, these labourers would have to be sent home and then called back two months later for taking up nurseries first and then transplanting the paddy in irrigated fields. This is expensive proposition and hence what is done these days is to prepare paddy nurseries even as the wheat crop is yet to be harvested, and after this is done, the fields are tilled and flooded with ground water extracted limitlessly and the same labour does the transplanting before returning home, only to head westwards again during the months of August/September when this early-sown paddy is fit for harvesting. Immediately thereafter, Rabi wheat is sown from early October.

Eminent soil scientists have been warning people against this practice as it is damaging soil health considerably. Besides, the extraction of ground water on an unlimited scale is also pushing down the water table in north-west India, not endowed with plentiful rainfall (although canal irrigation is available). It is time, scientists say, that the rice-wheat rotation is given up in favour of a new cropping pattern, at least for a limited period.

It will be rash to claim that India has not only attained self-sufficiency in foodgrains but also ensured food security, because 200 to 300 million still suffer from gnaws of hunger. However, one feels that for sometime at least, farmers should give up cultivation of the major cereals endlessly and take up, for a change, pulses and oilseeds in areas with assured irrigation and soils rich in nutrients. India has to import thousands of crores of rupees worth of pulses and edible oil every year, and from next year (April 2001) all quantitative restrictions on import of agricultural produce would have to be removed.

One way to stop this impending catastrophe is to take to pulses and oilseeds growing in rich soils and not on degraded one as is the current practice. We can prevent dumping of pulses and palmolein in India if we, for some years, reduce the scale of growing paddy or wheat and take up pulses and oilseeds instead by breaking the rice-wheat rotation cycle. This diversification would, one hopes, not only improve soil health, but also make the country self-sufficient in pulses and oilseeds.

It is relevant in this connection to quote from the National Agriculture policy adopted by the government in July 2000. It says : "Consequent upon dismantling of quantitative restrictions on imports as per WTO Agreement on Agriculture, commodity-wise strategies and arrangements for protecting the grower from adverse impact of undue price fluctuations in world markets and for promoting exports will be formulated. Apart from price competition, other aspects of marketing such as quality, choice, health and bio-safety will be promoted. Exports of horticultural produce and marine products will receive particular emphasis".

The extent of diversification of agriculture that has taken place in recent years in the field of horticulture is indeed unprecedented. Take apples for example. Even forty years ago,

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this fruit was treated as a luxury item because there was only one source from where surplus could be exported—the Kashmir valley. The apple revolution in Himachal Pradesh has made this fruit available now in every town and village not only in India but also in neighbouring Bangladesh, and at affordable prices.

Or take grapes. This too was a luxury immediately after partition because the only source was Chaman in Baluchistan. Kashmir valley too used to grow grapes. Today, Maharashtra, Karnataka and Andhra Pradesh in the South and Punjab and Haryana in the north have been producing good quality grapes. The Maharashtra grape growers' co-operative, Mahagrape, has now been exporting high-quality grapes to the London market where our grapes are replacing those from Chile.

In fact, India is in a position to produce almost any type of horticultural crop as we have extremely varied climate. In 1998-99, India produced 44.04 million tonnes of fruits, the second country in the world in horticultural production after China. It would not be a bad idea to divert some of the land now devoted to wheat and rice in several states to fruits, particularly those suitable for export.

India is also the second largest producer of vegetables in the world (87.53 million tonnes in 1998-99). Again, most of the vegetables except probably potatoes and onions are produced in degraded land. Reclaiming such land for growing high-quality vegetables for export should be undertaken on a large scale, aimed at the affluent countries in West Asia.

Coming back to foodgrains, one must take note of the fact that of the nearly 206 million tonnes produced during 1999-2000, almost 175 million tonnes constituted rice and wheat only. Supposing a killer disease or pest attack destroys these two major cereal cropes, how do we survive ?

The Indian Council of Agricultural Research (ICAR) has of late taken up a new scheme for development of certain varieties of so called coarse grains such as various types of millets (kodo, kulthi and the like) which has been traditionally the staple food of not only tribals but also the poorer sections of the rural population. These grains, nutritionally are in no way

**The nutrient-rich fruits and vegetables will take the pride of place on the dining tables of the new millennium and it is for this purpose that ICAR has allocated Rs. 213 crore for strengthening research on horticulture during the IX Plan, more than double the VIII Plan allocation of Rs. 104.70 crore.**

inferior to rice or wheat, but an additional advantage of these grains are that they are cheaper than these two elite grains. These millets along with kasava are storehouses for future dietal needs in case of a mishap with regard to the production of wheat and rice.

One recalls in this connection the efforts in the early fifties by the late K.M. Munshi and his illustrious wife Leelavati Munshi to set up a chain of restaurants in the country (one was located behind the row of shops on Janpath, New Delhi) which served only non-cereal foods. In fact this experiment was extended to railway trains too and several Janata Express trains had pantry cars serving "Annapurna" food, the name of restaurant chain. May be the acute shortage of rice and wheat those days when India lived a "ship-to-mouth" existence had promoted the Munshis to launch the "Annapurna" scheme and probably the chain disappeared after the foodgrains situation had eased somewhat towards the end of the fifties (Rafi Ahmed Kidwai, as Food and Agriculture Minister, had abolished rationing in the country), but it is time the Annapurna scheme of the yore is revived.

We are reproducing a table here which shows that in future the demand for—at least rice/wheat cereals—will not grow as fast as for fruits, vegetables, fish, milk, meat and eggs. This will show that while by 2030, the demand for wheat and rice is unlikely to rise by more than 30 per cent, and total foodgrains as such by a little over fifty per cent, that of potato will grow by about 50 per cent, and that of vegetables will grow by something like 120 per cent. Demand for fruits will grow by more or less 100 per cent, of milk by 100 per cent or thereabout, of meat by more or less than 100 per cent, of eggs by nearly 150 per cent and of fish too by more than 100 per cent.

The estimates, presented by Dr. R.S. Paroda. Former Director General of ICAR, and published in the Hindu survey on Indian Agriculture, 2000, is a pointer towards diversification of our food basket, away from the elite grains of rice and wheat.

The nutrient-rich fruits and vegetables will take the pride of place on the dining tables of the new millennium and it is for this purpose that ICAR has allocated Rs. 213 crore for strengthening research on horticulture during the IX Plan, more than double the VIII Plan allocation of Rs. 104.70 crore. The Horticulture Division of ICAR has seven major

**Demand for Various Foods in India (Thousand tonnes)**

| Food | Year 2000 | | Year 2015 | | Year 2000 | |
|---|---|---|---|---|---|---|
| | LIG | HIG | LIG | HIG | LIG | HIG |
| Rice | 84417 | 84255 | 101886 | 101441 | 114499 | 113893 |
| Wheat | 63375 | 62545 | 74607 | 72411 | 83045 | 80087 |
| Maize | 10466 | 10281 | 12196 | 11714 | 13522 | 12876 |
| Other coarse grains | 21803 | 21419 | 25407 | 24403 | 28171 | 26825 |
| Total cereals | 180061 | 178500 | 214096 | 209969 | 239238 | 233681 |
| Pulses | 16599 | 17028 | 21303 | 22578 | 24515 | 26312 |
| Foodgrains | 196659 | 195528 | 235399 | 232547 | 263752 | 259993 |
| Potato | 19905 | 20716 | 26394 | 28911 | 30760 | 34370 |
| Edible oils | 8151 | 8324 | 10355 | 10863 | 11870 | 12581 |
| Vegetables | 83388 | 91165 | 123824 | 151861 | 150823 | 193562 |
| Fruits | 47688 | 51774 | 69678 | 84099 | 84336 | 106126 |
| Milk | 76932 | 82451 | 109092 | 127805 | 130502 | 158325 |
| Meat | 5335 | 5918 | 8196 | 10396 | 101181 | 13534 |
| Eggs | 1880 | 2086 | 2889 | 3664 | 3566 | 4770 |
| Fish | 5507 | 6108 | 8460 | 10731 | 10444 | 13971 |

LIG : Low-income growth (3.5% per capita GDP) HIG : High-income growth (5.5% per capita GDP)
*The Hindu Survey of Indian Agriculture 2000.*

R & D programmes covering fruit crops, vegetables, root and tuber crops, plantation crops, spices, floriculture and medicinal plants and post harvest management of horticultural crops including processing and value additions.

In fact, the horticulture sector has been allocated Rs. 1300 crore during the IX Plan (apart from the outlay on research programmes), one of the programmes being development of horticulture in the tribal and hilly areas and modernisation of cold storages.

In the pre-Green Revolution days, senior citizens of today who were young men and women at that time, had survived famines by taking coarse grains like jowar in non-traditional areas and in households which never had to encounter this grain and by making chapatis from imported millets from Argentina among other countries. It was a great relief for them when rice and wheat again began to flow in the market by the end of the fifties and sixties. Probably, for an entirely different reason, the so called coarse grains and millets of various types will stage a comeback in the non-too-distant a future.

This shows that our Sunderban farmer, mentioned at the beginning of this article, like many other wise farmers, have visualised what lies in store in future, In fact, he learnt the diverisfied farming system from his forefathers. Traditional wisdom today beckons us to stick to the pattern set by them, while taking full advantage of the scientific advances in agriculture including bio-technology such as tissue culture, bio-fertilisers and bio-pesticides. A marriage between tradition and modern will ensure food security and nutrition security for the nation for a long time to come and which should be the "mantra" during the early decades of the new millennium. ❐

# Rainfed Agriculture : Research and Development Perspective

**P.C.Bhatia and H.P.Singh**

***Rainfed agriculture research needs to be conducted with water as the nucleus resource. Future research is to be conducted on well-defined watershed units. This would require interdisciplinary teamwork involving socio-economic and bio-physical disciplines.***

INDIA MADE RAPID strides in food production during the last three decades resulting in self-sufficiency and surplus production. However, feeding ever increasing population through the next 25 years remains an uphill task. The country will have to feed about 1.3 billion people by 2020 requiring 5-6 m tonnes of additional foodgrains every year. The country, as per the recent National Policy on Agriculture, requires to achieve 4% growth rate in foodgrains production.

Rainfed agriculture extends over 94 million ha that constitutes nearly 65% of the net cultivated area. It contributs 40% of foodgrains production and supports 40% of the total population. Even when the full irrigation potential of the country is realised, 50% of the net sown area will continue to remain rainfed. Presently 95% area under coarse cereals, 91% under pulses, 80% under oilseeds, 65% under cotton and 53% under rice is rainfed. Two-thirds of livestock population live in these areas, with small ruminants, sheep and goat predominating. The rainfed areas in the country (excluding arid zone) i.e. semi arid and sub humid is distributed in the 3-13 agro ecological regions (AER) of National Bureau of Soil Survey & Land Use Planning and occupying 27 sub regions. These facts highlight the importance of rainfed farming in the country.

There is indeed a situation of no escape from improvement of production and productivity in rainfed areas if the growing demands for foodgrains, fodder and fibre are to be met on a sustainable basis.

Soil and water are the basic resources in rainfed agriculture for stabilizing the production. About 40.26 m ha of geographical area falls in the rainfall zone of 500-750 mm with annual rainwater availability of 25.16 m ha m and another 65.86 m ha area falls in 750-1000 mm rainfall zone with 57.63 m ha m of rain water availability. Despite this substantive rainfall droughts and crop failures are frequent in rainfed regions mainly because of the aberrant monsoon and inadequate soil and rainwater management resulting in land degradation. Consequently the problems of rainfed agriculture have been compounding with water deficit for crop production on the one hand and continuing land degradation on the other. India's 400 m.ha 74% precipitation is received primarily through South-West Monsoon and North East Monsoon, the details are as under :

**Table 1**

**Rainwater availability in India during monsoon and pre-monsoon period**

| Monsoon activity | m ha m | % |
|---|---|---|
| South-west | 296 | 74 |
| North-east | 12 | 3 |
| Premonsoon | 52 | 13 |
| Post monsoon | 40 | 10 |
| Total | 400 | 100 |

## Research Achievements

The Central Research Institute for Dryland Agriculture with a network of 22 All India Coordinated

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Research Project on Dryland Agriculture, 8 Operational Research Project and 25 All India Coordinated Research Project on Agrometorology centres with a Ninth plan budget of Rs. 30 crore developed location-specific technologies for rainfed regions in the country. These include analyses of historical weather data and development of a large database of derived weather parameters for the various agro-ecological regions, resource characterization of the rainfed regions such as delineation of drought prone areas, identification of length of effective growing season, potential areas suitable for intercropping/double cropping, applicability of long range weather forecasts contingent crop plans and management strategies, establishment of threshold values for moisture availability, weather pest relationships and development of simple crop weather models and validation of dynamic crop growth simulation models.

## Efficient Technologies

The efficient technologies for soil and water conservation that have been improved and systematized include : efficient conservation of rain water through a number of inter-terrace land treatments, contour, graded and field bunds, in situ water harvesting, indentification of appropriate vegetative barriers like vetiver, lemon grass, Gliricidia and Cenchrus to arrest soil degradation for different production systems (Table 2). Some of the technologies that have been generated are : (i) Micro-relief system for crops, ridge-furrow system and in situ rainwater harvesting (fruit trees), (ii) Off-season and deep tillage for increasing moisture conservation and weed control, (iii) Broad bed furrow system for kharif crops in medium rainfall regions, compartmental bunding and tied ridging for rabi crop in bi-model low rainfall regions, (iv) Water harvesting and groundwater recharge through small farm ponds, utilitzation of the harvested water for enhancement of the yields of kharif crops and come-up irrigation for rabi crops.

To match the soil and rainwater conservation measures in a system mode efficient cropping systems involving most efficient crops, varieties and cropping systems (inter and double cropping) were developed for different agroclimatic zones. Agro-techniques such as, optimal time of seeding, plant densities and nutrients (Table 2) through integrated nutrient management strategies were worked out. The technologies pertaining to the alternative land use systems viz., pasture, silvipasture, hortipasture, dryland, horticulture, dryland horticulture, agrisilviculture, agrihorticulture have been developed and their economics worked out for different rainfed production systems.

**Table 2**

**Integrated use of organic and inorganic on sorghum**

| Source/Leval | Grain Yield * q ha-1 | |
|---|---|---|
| | 40 kg N $ha^{-1}$ | 60 kg N $ha^{-1}$ |
| Urea | 15.1 | 20.2 |
| Sorghum stover | 5.2 | 5.9 |
| Leucaena (leaves + Twigs) | 11.0 | 12.7 |
| Gliricidia/Groundnut shell | 10.4 | 13.4 |
| Urea + Sorghum stover (1:1) | 12.4 | 16.2 |
| Urea + Leucaena (1:1) | 14.3 | 19.5 |
| Urea + Gliricidia/ Groundutt Shell (1:1) | 16.4 | 18.0 |

* Mean of 3 years

Proper tillage and precise placement of seed and fertilizer in the moist zone are most crucial for successful crop establishment in the rainfed regions. To meet this important need, suitable implements such as CRIDA plough drill, plough planter, groundnut planter for rainfed Alfisols and Vertisols, Malvya multi-purpose machine for Entisols of eastern U.P., Birsa seed-cum-fertilizer drill for planting rice, fingermillet, wheat and safflower, ridger seeder for Aridisols of north-west for sowing millets and pulses, Shivaji multi-purpose machine for Vertisols of Solapur, and ragi seeder for Alfisols of Anantapur and Bangalore were developed and evaluated under on-farm conditions. Development of agro-techniques and evaluation of germplasm of high value crops like curry leaf, henna and Jetafra was also carried out for adoption in rainfed Alfisols.

## Impact & Assessment

Earlier research efforts through AICRPDA operational research programmes helped in identifying the potential production strategies through a combination of simple agro-techniques, rainwater management, improved bio-types of crops, soil fertility management to overcome nutritional constraints and weed control to avoid non-productive use of soil stored moisture and nutrients. As a result, the productivity of many crops rose by 100-200% due to adoption of improved rainfed technologies during the last three decades. More importantly, despite aberrations in the year-to-year rainfall and within the year, occurrence of crop failure could be minimised to a considerable extent.

ICAR Institutes provided the technical back up for 30 model watersheds in the country during the VII Five Year Plan that led to the launching of a major initiative on watershed development inrainfed areas. National Watershed Development Programme for Rainfed Agriculture (NWDPRA) during VIII Five Year Plan.

Creation of water conservation and storage structures under the watershed

programme led to improved water availability in terms of additional surface storage in check dams, water harvesting ponds and also greater recharge of ground water. The number of dug wells and the water table increased significantly in a number of watershed situations. The increased water availability in the open wells and bundhis averaged across 14 watersheds, led to increase in the cropping intensity by 50% over a five-year period. Additional area could thus be brought into cultivation. At some locations, double cropping became possible. The conservation measures also increased the rain water use efficiency. With assured water supply high value crops replaced the traditional low yielding ones in some situations.

With increase in productivity and cropping intensity, the input use and investments increased providing greater employment opportunities in the watershed villages as compared to the non-watershed villages. A measurable impact on water resource generation and crop productivity could be recorded in some watersheds which earned the National Productivity Awards.

## New Technologies

Based on the research conducted in dryland agriculture network during the last few decades, a number of technologies have emerged and recommended to the farmers. The productivity of coarse cereals increased by 65% despite decrease in the total area. The productivity of oilseeds increased by 57% due to increase in total area as well as area under irrigation while the increase in the productivity of pulses was marginal. These changes indicate that the technology improvement was more beneficial (10-15%) to nutritive cereals than pulses. In sorghum, the major improvement was observed in the kharif, but not to post rainy season. The future priority of research in sorghum thus, should be on rabi season. The yields of pearlmillet fluctuated widely partly due to disease occurrence. Lack of timely tillage operations, availability of good quality seed and inputs, appropriate price incentives and marketing facilities and poor storability of grains are serious constriants to coarse cereal crop production. In case of oilseeds, the productivity of gains were mainly in rapeseed—mustard and soyabean.

**Based on the research conducted in dryland agriculture network a number of technologies emerge . The productivity of coarse cereals increased by 65% despite decrease in the total area.**

Considering the overall scenario of technology adoption in rainfed areas, it can be stated that improved crops and their varieties have been adopted largely by the farmers depending upon the availability of the seed. However, the adoption of resource conservation technologies has not been very encouraging. Use of fertilizers was accepted only in some high value rainfed crops like cotton, groundnut and soyabean.

## Constraints

Rainfed areas suffer from numerous biophysical and socio-economic constraints, which considerably limit the productivity of crops and livestock. The major constraints are : (i) Low and erratic rainfall, (ii) Land degradation, (iii) Low levels of input use and technology adoption, (iv) Low drought power availability, (v) Inadequate fodder availability and poor livestock health and meat production (vi) Resource poor farmers and inadequate credit facilities.

### a) Infrastructure

ICAR with the visionary support of the Planning Commission, initiated network/agro-climatic soil frame work based research programme for research in 1971. The climatic zones identified by the Planning Commission were considered for development of location specific research programmes. Simultaneously, research on agro-climatic conditions was initiated to provide back-up for efficient development of location—specific research programmes. In this context, historical weather data were analysed and large database was developed. Over the last three decades, based on the agro-ecological and socio-economic characterization of rainfed areas, technologies for efficient plant protection have been developed through an inter-disciplinary and location specific approach.

In 1980s' the National Model Watershed Development Programme spread over 47 locations in different agro-ecological situations was launched. The effort was successful in leading to impressive gains particularly reflected in recharging of ground water due to harvesting of rainwater. Improved crops and varieties were also adopted by the farmers throughout the country depending upon the availability of appropriate seed material. Intercropping involving cereal and legume components was accepted in many areas.

### b) Technical

- Lack of appreciation of farmers perspective : Farmers socio-economic conditions along with natural resources inventory were not considered for technology development either at the research farm or in Operational Research Programme implemented in farmers' fields.
- Lack of on-farm research as a

continuum to on-station research. Evaluation of technological options for location specific problem solving in a participatory technology development (PTD) mode is absolutely necessary for technology adoption by clients. Most of the operational research carried out hitherto was in a demonstration mode.

- Reliance on developing single technological solutions. It is only the approach of "basket of technological options" that can trigger technology adoption. This will enable the farmers to choose a particular technique depending upon the socio-economic conditions, requirements and priorities.
- Lack of farming systems perspective. Different components of production systems like livestock management, agro-forestry and horticulture etc. were not integrated with arable crop production to the desired extent. Hence synergy among components could not be harnessed.
- Lack of appreciation of available indigenous technical knowledge (ITK). Vast wisdom exists in farming community world wide. In fact, ITK refinements carried out through on station research and PTD should form the stepping stone for technology diffusion in resource poor rainfed areas.

**c) Transfer of Technology**

- Inadequate extension infrastructure particularly in remote areas
- Lack of appropriate development infrastructure (marketing, input and credit supply etc.)
- Largely input based participation of farmers in extension programmes. Interactive participation of farmers has been missing which only can lead to their voluntary participation in the long run
- Weak inter-sectoral (agriculture, horticulture, animal husbandry etc) coordination in development programme.
- Lack of efforts towards community mobilisation to resolve conflicts/differences in the fabric of rural society; Common Property Resources (CPRs) which are so vital in rainfed areas cannot be efficiently managed without community mobilisation.

The technologies developed at one location by and large lack replicability at other locations without further investment in research and development. Risk inherent to the rainfed regions poses a tremendous challenge in adoption and diffusion of improved dryland technologies. High concentration of livestock, ecological heterogeneity, a weak market base, poor input supporting system, labour mobility necessitate greater attention to develop alternative interphasing arrangements for research and development in rainfed regions. Keeping these conditions in view there is need to focus on farm research linked to on-station research with the farmers as active participants.

## Overcoming Constraints

**i) Technology development**

To address—some of the critical problems and to develop technology in participatory mode, Indian Council of Agricultural Research, New Delhi recently launched a major project viz., National Agricultural Technology Project (NATP) across the country under different agro-eco systems which include arid, rainfed, irrigated, coastal and hill and mountainous. Under this project, in the rainfed ecosystem the responsibility of coordination of research and technology development activities in about 312 districts of the country spread over 13 items with a budget outlay of Rs. 130 crore, the focus is on 5 major items include rice, oilseeds, pulses, cotton.

Based on the available data, the constraints and priorities in relation to agriculture sector have been identified and suitable projects launched. The major themes on which research and technology development is being focussed include : (a) rainwater management (b) watershed development (c) excess water and drainage (d) low cost integrated nutrient management options (e) integrated pest management (f) weed control (g) identification and development of suitable cultivars of various crops (h) alternative land use systems and horticulture development (i) organic matter enhancement and soil quality improvement (j) enhancement of production of fish, poultry, goats and other livestocks and dairying (k) fodder production and feed quality improvement and (l) storage and post harvest technology. The activities of the above research domains will be executed under on-farm situations with active participation of the farmers.

**ii) Transfer of Technology**

Strategic planning for development of rainfed areas is crucial and central for getting stable productivity. In this context it would be pertinent to plan the programme into short-term (5 years), medium term (10 years) and long-term (20 years) interventions.

Technologies to address the problem on short-term aim at immediate benefit to farmers. These consist of 'doable' technologies which the farmers can adopt at their farm level (irrespective of farm size) as far as possible on watershed basis with a little or no help from external agencies. Drought tolerant varieties, interbund treatments like keyline

tillage, summer ploughing, ploughing/sowing across the slope, green loppings land cover cum manure treatment; vegetative barriers, ridge-furrow configurations for short term measures. These technologies aim at bringing out an impact within a short span of 2-5 years.

Once the farmers begin to realize the benefits of adopting technologies (through short-term measures), they can better respond to participate in the adoption of medium and long-term measures. Integrated watershed management involving farmer participatory technology development (PTD) is central to medium term measures. The technologies here should have a farming systems perspective. Regularziation of drainage channels, diversion drains, ground water recharge, water harvesting on small scale, in medium size reservoirs and renovation of existing tanks, etc., and adoption of alternative land use systems are the examples of interventions as medium term measures.

Areas covered by shallow ravines can be utilized for silvipasture, which will also encourage livestock enterprise. Erecting mechanical checks and stabilization of ravine slopes wherever possible should be taken up to prevent further degradation.

Long-term measures also include structures, which are erected to regulate overland flow and reduce peak flow of watershed areas on macro scale, say 2000-5000 ha. The assets created under long-term measures are of permanent nature and need investment.

**iii) On-Farm Research and Participatory Technology Development (PTD)**

To consolidate the benefits of on-farm research in rainfed region, besides on-going programme of front line demonstrations efforts should be made to start pilot projects on transfer of technology in participatory mode on micro watershed basis ranging from 200 - 500 ha. It is necessary that extension services in rainfed areas are to be strengthened by establishing KVKs/ Farm training centres. The emphasis should be skill oriented training to the farmers on horticulture, alternate crops and demonstration of viable technology. In addition to this, service of media namely, Radio, TV and its private channels should be used to provide necessary support by broadcasting daily programmes on agriculture. The coordination committee consisting of the representatives of various departmental agencies, supply agencies, credit and marketing agencies should be made more functional and active. Effective linkage between research, extension and client system has to be established in the rainfed areas. A bottom-up approach in technology generation, devising extension strategies and identification of prevailing constraints, keeping in view of the farmers problem has to be given priority. Multi-disciplinary team of scientists should give priority to work together with the farmers for minimising the adoption gap with the farming community.

Indigenous technical knowledge (ITK) exists with the farming community in the area of natural resources management. Technologies developed based on ITKs or their refinements are likely to be more readily accepted by the farming community. ITK refinement, therefore, should be an important component of PTD for control of land degradation and enhancement of productivity.

There is need to develop linkage between Researchers, Line Department/NGO and Farmers for successful technology transfer. The Panchayat Raj institution could be used for the implementation of watershed based technologies. The concept of user groups, village volunteers (Mitra Kisan) need to be promoted further for speedier acceptance and implementation of the watershed technologies.

**iv) Consortium Approach**

At present, a multitude of government institutions, NGOs and private sector/corporate organizations are working for improving agricultural productivity and controlling land degradation. These isolated efforts are quite often handicapped for want of skilled manpower as well as the limited exposure to knowledge pool being upgraded with new research initiatives. There is therefore, need for adoption of a consortium approach to share knowledge and experience, with a view to addressing the problems in the right perspective.

It is very important to integrate the short, medium and long term technologies wherever possible on a watershed scale, otherwise on unit area basis and to take up these measures simultaneously. This will result not only in ensuring peoples' participation right from the beginning but also in sustaining it throughout the programme.

**v) Policy Issues**

The research strategies in rainfed areas need to be supported with appropriate policy initiatives. Foremost is evolving an institutional framework for the effective involvement of Panchayat Raj institutions with built in accountability in watershed development programmes. Being a group activity, the additional resources generated in a watershed can be translated into productivity gains only when the assets are

maintained over a long period and gains are equitably shared. Formation of 'Bhoomi Panchayats' on the pattern 'Pani Panchayat' could be one option.

Extension of crop insurance schemes to rainfed crops can play a catalytic role in motivating farmers to use higher inputs and adopt new technology despite the risk factors. Credit availability and input supply system; needs substantial improvement if expensive inputs like fertilizer and pesticides are to be used judiciously and for creation of long term assets in the form of conservation structures. Finally, a new pilot project focusing on farmers participatory on-farm research need to be taken up on a mission mode for the area based development, besides commodity based mission on pulses, oilseeds and cotton. In such projects, all the technology and inputs needed to upgrade the total productivity of an area like a watershed will have to be marshalled and precise economic gains documented over a 5 to 10 year period.

- Climate change, environmental quality and crop growth modeling for major rainfed production systems
- Developing weather-pest/disease relationships
- Environmental stress on crops and livestock
- Rainwater management on watershed basis
- Appropriate mix of mechanical and vegetative means
- Designs for water harvesting and groundwater recharge
- Focus on on-farm research in a farming systems perspective and technology development
- Integration of soil-water-nutrient management and alleviation of land degradation problems
- Increasing productivity and sustainability through eco friendly crops and cropping systems
- Stable genotypes tolerant to biotic and abiotic stresses
- Post harvest management, value addition and product development
- Crop diversification strategies through non conventional crops, post harvest management value addition and product development
- Integration of indigenous knowledge techniques with modern knowledge, refinement and utilization
- Alternative land use strategies focusing silvi, agri, horti, pastural systems. Selective mechanization to bring in more efficiency
- Integrating livestock management with rainfed farming through farming systems research
- Technology Assessment and Refinement through farmers participatory approach
- Generating self supported input systems for technology adoption
- Technology transfer in production system model
- Impact analysis of the past and present technologies
- Participatory technology development through on-farm research

## Future Strategies

The integrated management of natural resources in a farming system mode is the key to achieve sustainability in the rainfed agro-ecosystem. The sustainability issues comprise 5 major components i.e., productivity optimization to a level as near to agro-ecological potential as feasible; dynamic economic viability; natural resource conservation and efficient utilization, diversification, environmental upgradation and social relevance. The constraints to attain systainability in rainfed agriculture are multiple and vary from one agro-eco sub-region to another across the country. Therefore, future research thrusts ought to contribute towards evolution of technologies that put together all key components in a synergistic equilibrium thereby imparting sustainability to rainfed production across varied agro-ecological niches.

Water is the foremost critical production factor in rainfed farming. The rainfed agriculture research, thus, needs to be conducted with water as the nucleus resource. Future research is to be conducted on well-defined watershed units. This would require interdisciplinary teamwork involving socio-economic and bio-physical disciplines. Continued decline in soil organic matter is yet another challenging issue in semi arid areas due to poor biomass production and inadequate integration of crop and livestock farming. Hence, the research strategies and alternative land use systems should include developing appropriate agroforestry, crop diversification strategies to meet fodder and crop biomass to be used for maintaining of sustenance soil quality.

The future research thrusts in rainfed areas are :

- Resource characterization and digitization of database
- Collect and compile long-term crop weather data in different production systems
- Development of response farming strategies and operational agrometeorological models for agromet advisory services. ❐

# Technology Transfer for Transformation of Rural Areas

T.V. Satyanarayanan

TRANSFER OF TECHNOLOGY is what keeps the wheels of agricultural development moving. The success of agricultural and rural development strategy, initiated, planned and developed by the policy maker, the planner and the scientist, hinges on the effectiveness of the extension machinery and personnel, whose task is to transfer the technology from the lab to the land. Technology transfer has brought about a transformation in the lives of people in the countryside and the farmers and others who have adopted the new technology and methods of cultivation are happy to share their experiences with others. "Seeing is believing" and success in one place triggers a chain reaction, enthusing others to emulate it.

***Probably, one way to strengthen the extension network would be through political parties which can have their own trained extension personnel to reach out to the remote and backward areas.***

Two striking instances of success of technology transfer come readily to my mind, though such success stories are a plenty in all parts of the country.

In mid-eighties, when the Green Revolution was steadily spreading to reach to areas which were comparatively backward in agriculture, a team of journalists visited a village not far from the Agriculture University at Jabalpur. That was the time when new Jowar varieties were proving their worth in terms of yield potential and ability to withstand moisture stress. One of the beneficiaries of new variety and production technology was an old farmer who owned a small farm. He was visibly happy to see the journalists, accompanied by the extension scientists of the University, who were visiting his farm after he had harvested a bumper crop. Asked how much more money he got as a result of the new technology he said he could not quantify it, but, he said, he could share a secret with us.

It was his long cherished dream, he said to undertake a pilgrimage to the temple towns in South India, including Rameswaram. He could never do it as his earnings from his farm were very meagre through cultivation of traditional varieties. By adopting the new technology he got enough money to undertake the pilgrimage with his wife and fulfil his life's ambition, he said with a sense of satisfaction. "Had I been younger, I don't know what I would have done with the extra money," he added in a lighter vein.

Another example of technology transfer success is in Vypeen island in Kochi in Kerala. The people in the small islands were so poor that they had formed a cooperative with a small contribution from each family to deal with difficult situations like death in a household. With a cooperative organisation there, the nearby research centre of the Central Marine Fisheries Research Institute of Indian Council of Agricultural Research (ICAR) found it a good place to test its technology in field conditions. The members of the cooperatives were enthusiastic to contribute their voluntary labour and adopt the new technology. Wastelands were converted into fish farms where fast breeding species were introduced. Areas between fish ponds were planted with high yielding coconut trees. Soon the people of the area earned enough money, thanks to the new technology that their lifestyle started changing for the better. Much of the money they have earned

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through sale of rich harvest of fish and coconut, they are investing in the education of their children.

These examples, which are illustrative, give an insight into the success of Green Revolution, White Revolution, Blue Revolution and so on. Successes have also been achieved in such areas as wastelands with saline and alkaline soils, forest areas where shifting cultivation was a problem, and coastal areas subjected to soil erosion, besides arid and semi-arid regions.

Technology transfer is the complex task which is multi-disciplinary and multi-institutional in approach. It calls for close coordination in the functioning of agriculture departments, research organisations, educational institutions and extension agencies.

Broadly, there are four major streams devoted to Extension work for agricultural and allied production technologies—the Extension system of the Union Ministry of Agriculture and State Departments of Agriculture; the ICAR Extension System; the Department of Rural Development and development work by Non-Government organisations.

It is a tribute to those involved in technology transfer that the country's foodgrains production which stood at 50.9 million tonnes when the First Plan was launched, has now risen to more than 200 million tonnes—a four-fold increase. There has been a quantum jump in wheat production during this period from 6.5 million tonnes to over 70 million tonnes—more than ten times—while rice output has increased from 20.6 million tonnes to 86 million tonnes. Significant increases have been obtained in maize, sugarcane, cotton, potato and many other crops. Besides India has emerged as the world's largest producer of milk and fruits and second largest producer of vegetables, to cite only a few of the achievements in agriculture and allied sectors.

Despite these achievements, there are still many gaps in the agricultural development which need to be bridged. Imbalances in production persist, both crop-wise and region-wise. Productivity levels in many crops are still far behind world average, not to speak of levels obtained in advanced countries. Filling these gaps is a major challenge for the Extension machinery, which takes the technology to the farming community.

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The main Extension work is done by the Union Agriculture Ministry and State Agriculture departments who provide Extension functionaries and farmers with information, training and other support on continuous basis regarding improved production technologies.

Major policy guidelines are laid down by Extension Division of the Department of Agriculture and Cooporation and specific programmes and activities are implemented by the Directorate of Extension, at the national level. The Directorate has four technical units : Extension Management, Extension Training; Farm Information and Farm Women Development Programme. The Extension Management Unit has a number of programmes and schemes to strengthen Extension services. One of them is Agriculture Extension through Voluntary Organisations, which augments the coverage and efficiency of Extension services by integrating the efforts of selected NGOs with the main Extension services. Another scheme, "Strengthening of Research-Extension-Farmer Linkage" interfaces between the Department of Agriculture and ICAR organisations new scheme to evolve joint strategies for research and development.

A new scheme that was launched last year was innovations in technology dissemination as a component of the World Bank Aided National Agricultural Technology Project. The objective is to sustain and strengthen research and Extension services and test new institutional arrangements for technology transfer involving the government and non-government agencies at the district level in selected states. An agricultural extension management agency has been registered as a society in each pilot district of six selected states. A significant development in the implementation of transfer of technology programmes is the increasing importance given to farm women, hitherto a neglected section of society. Women are described as "invisible farmers". They play a key role in the entire food system from the selection of seeds to sowing, manuring, weeding, harvesting, threshing, winnowing, drying, stacking and storing, besides doing other back breaking chores of housekeeping. In dairying, their role is much more than that of their male counterparts.

According to and survey by the U.N. Food and Agriculture Organisation (FAO), the technology transfer programmes world-wide are

male-oriented. Female farmers receive only 5 per cent of all agricultural extension services and only 15 per cent of world extension workers are women.

India's Farm Women Development Programme seeks to correct this imbalance to some extent. A Central sector scheme called women in Agriculture has been approved for implementation in one district each in 12 states during the Ninth Plan. Special programmes have been drawn up for farm women under the scheme. Besides, there are many schemes at the State level to provide training to farm women in States like Tamil Nadu, Orissa, Madhya Pradesh, Gujarat and Andhra Pradesh.

ICAR, the apex research body, has its own programme for women. It has set up a National Centre for Women in Agriculture in Bhubaneswar and a sub-centre at Bhopal. The National Centre organises training programme for technological empowerment of women in crop production and post-harvest operations so that women folk are aware of all latest technologies developed by scientists. The Centre's work also includes development of specific technologies for women in such fields as animal husbandry, fisheries, horticulture and sericulture. The sub-centre at Bhopal identifies research relating to agricultural engineering to reduce women's drudgery in agricultural operations.

For the farming community in general—for both men and women—ICAR has its own effective Extension Programme, the most important being Krishi Vigyan Kendras (KVKs). The KVK activities include "teaching by doing", "learning by doing" in agriculture and allied areas, on-farm testing of technologies, in-service testing of extension personnel and organising front-line demonstrations.

The KVKs, 261 in all, organise Kisan Melas, Field Days, Kisan Gosthies, Film Shows, Radio and TV talks and exhibitions and conduct training courses for rural youth and training programmes for in-service personnel, besides holding front-line demonstrations in cooperation with other agencies to spread the production technologies.

Besides, the Council has eight Trainers' Training Centres in frontier areas of technology for in-service training of KVK scientists, development officers, Extension officers, University teachers and entrepreneurs, vocational training for the rural and urban youth for self-employment. In these centres training is imparted through work experience, lectures, field visits, demonstrations and discussions.

Technology assessment and refinement is done through an Institution-Village-Linkage Programme. It is at present implemented in 42 centres of selected ICAR institutes and State Agricultural Universities.

## Impact

The impact of the frontline Extension systems of KVKs has triggered activities in states, and among them are Maharashtra's Rytu Samghams of Landless Labourers to create awareness among the members about material resource management, and "Innovative Farmers' Club" (in Ahmednagar) to discuss technologies like goat rearing, organic farming and advantages of drip irrigation.

While extension projects and programmes are many and have done considerably good work, there are still miles to go before technology reaches all sections of more than 100 million farm families in the country. The gaps in yields achieved in laboratories on the one hand and farmers fields on the other are an indication that there are still vast reservoirs of untapped potential. The technology transfer is particularly slow in drylands, that is, areas dependent on rains, which constitute 60 per cent of the cultivated area in the country but contribute 40 per cent to the national food basket. Among the constraints in technology transfer, the major one is finance. No doubt, States are doing their best despite the resource constraints.

To cite a few examples, Maharashtra has gone in for integrated Extension delivery by merging development functions of agricultural and allied department at district and below levels. Rajasthan is encouraging NGOs and para-Extension workers while Kerala has established Krishi Bhawans at Panchayat levels promoting group farming approach. Punjab and Andhra Pradesh are demonstrating private sector involvement in transfer of technology.

At the farmers' level a major constraint in technology transfer is that the majority of them are small and marginal farmers, not financially sound to adopt new technologies.

Probably, one way to strengthen the extension network would be not only through NGOs and private sector organisations, which are active in some parts, but also through political parties which can have their own trained extension personnel to reach out to the remote and backward areas. This work by political parties if they take it up seriously, would be in their enlightened self-interest since the areas which would benefit from their work can become their dependable vote banks.

Under a scheme, Members of Parliament are now getting Rs. one crore each to be spent on development activities in their constituencies. It would be interesting to conduct a survey and see how many of them are utilising, at least a part of the amount, to help in the transfer of technology to the rural community, and thereby augment the income and employment opportunities in those areas. ❐

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