

**POLICY
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Diversification of Agriculture for Human Nutrition



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Introduction

The current agricultural production scenario reflects some disturbing tendencies from the point of view of human nutrition, particularly in rural areas where production and consumption are directly linked, and for the poor everywhere. Decline in areas of coarse cereals and pulses and other so-called 'low-value' crops which provide access to better nutrition for the poor, illustrates this concern. On the other hand, substitution of these crops by those with higher productivity has improved calorie availability and incomes of farmers who can increasingly afford better nutrition. Over the last 10-15 years, there has been a remarkable spurt in production of horticultural crops, livestock and fisheries, driven largely by buoyant domestic demand. Average per capita consumption of these commodities has increased.

Data on nutritional status in the country in relation to norms developed by nutrition scientists, on the other hand, reveal the appalling status of nutrition, in general and of vulnerable sections of the population in particular. The National Academy of Agricultural Sciences organised a symposium,¹ to deliberate on these issues. Some salient observations, policy issues and recommendations emerging out of the deliberations are summarised below.

Food and Nutritional Security

Thanks to the Green Revolution, per capita availability of foodgrains has increased. With 200 million tonnes of foodgrains, calorie and protein deficiencies have largely been overcome. The country has achieved basic food security in terms of foodgrains. The averages, however, conceal some important differences. For example, distribution of food is highly unequal and the poor, who constitute nearly one-third of our population, continue to be food-deprived. Interregional and intrahousehold deficiencies are also significant.

Also, almost all the increase in foodgrain production has come from wheat and rice. The production of coarse grains (millets) and pulses has declined or remained stagnant, implying a decline in per capita availability of these commodities over time. Coarse grains have been important in the diets of the poor. These have relatively higher nutritive value in terms of proteins, vitamins and minerals compared to rice. Declines here, thus, affect food security of the poor qualitatively. Similar are the implications relating to pulses which are the major source of protein in vegetarian diets. Both pulses and coarse grains are important crops for dryland and fragile environments where poverty levels are high. Legumes have been the traditional restorer of soil fertility and declining area poses a threat to sustainability. Finally, the spectacular increase in foodgrain production and a reasonable overall agricultural performance has failed to eradicate malnutrition.

Nutritional security, thus, goes beyond food security as we understand the term. The latter means ensuring adequate availability of foodgrains to provide calorie and, may be, protein needs of the people, the former implies adequate supply of micronutrients such as vitamins and minerals as well. As we move up the development ladder, this becomes more relevant indicator of food security. To ensure nutritional security, increased availability of diverse types of food, such as millets, pulses, fruits and vegetables, foods of animal origin

(milk, eggs, meat, fish), besides cereals, is essential. While fruits and vegetables are rich sources of micronutrients, animal-based foods abound in quality proteins as well. Vegetables and fruits also contain some health-giving phytochemicals which are powerful antioxidants and detoxifying agents which protect against degenerative diseases. Marine fish is a rich source of long chain n-3 fatty acids which have important physiological role.

Diversification Scenario

Cropping patterns have traditionally been dominated by food needs. Commercial crops were confined to some regions and on relatively larger farms. The system we inherited at the time of independence became unsustainable as rapid population growth outstripped our capacity to produce food. Fruits, vegetables, milk, meat, fish, became luxury foods, whose demand was confined to the very small rich class in rural and urban areas. A food insecure nation, despite devoting bulk of its agricultural resources to food production, became chronic importer of food. Even extension of cultivation to marginal and sub-marginal lands did not help.

The Green Revolution transformed this scene. In less than a decade we were able to achieve reasonable food security. High growth in productivity of cereals spurred agricultural growth and incomes. Rising incomes prompted shifts in consumption patterns and demand for non-cereal food became buoyant. By mid-eighties expansion of area under cereals ceased. Producers too began to look for alternatives and the process of diversification set in. It became the *mantra* for agricultural development in the nineties. The following paragraphs document these developments briefly:

- In the *horticulture* sector, there has been 2-3 fold increase in production of fruits and vegetables in the last 10-15 years. Their area has gone up, particularly in rainfed, hilly, and coastal regions prompting fears of diversion of land from foodgrains. This has so far not materialised. Among fruits, banana, papaya, citrus and mango have contributed to the significant increase. All these are nutritionally rich fruits and their increased production has resulted in decline in real prices and penetration in rural markets.
- *Livestock* production has been increasing at 10-15 per cent over the last decade or two. Milk, eggs and meat production have registered spectacular growth. Despite these increases, the annual per capita availability is much below the amounts recommended by ICMR. In terms of these, the present availability is 86.4 per cent for milk, 16.7 per cent for eggs and 29.6 per cent for meat.
- *Fish* is one of the best sources of protein and fisheries sector has grown substantially. Marine products' industry is the largest foreign exchange earner. Scientific aquaculture and deep sea fishing have contributed to the growth of these sectors in the nineties. There are, however, reports that these developments have been unsustainable and have not contributed to livelihood security of small fishermen in coastal areas. The sector faces infrastructural constraints which inhibit exploitation of the potential.
- *Genetic engineering* is a powerful tool for improving the yields and quality of both plant and animal foods. Both macro- and micro-nutrient content can be enhanced

with the now available and evolving biotech tools. Some promising breakthroughs in improving the protein and micronutrient content of crops, such as maize, rice, rapeseed, tomato, etc., have been achieved. However, safety aspects of GMO foods have become an area of concern and debate, globally.

Issues

Changes in Food/Nutritional Security Status

There is agreement that increased per capita availability of cereals and a number of other foods has contributed to greater food security at the national level. At the household level, consumption expenditure surveys by the National Sample Survey Organisation reveal declining consumption of cereals and increases in livestock and horticultural products, sugar and edible oils implying an average improvement in nutritional status. These, as well as, results of the surveys of the National Nutrition Monitoring Board, bear out gains in calorie and protein content of diets, essentially from improvements in non-grain food consumption, driven by income growth and poverty reduction. These surveys, however, also reveal the inequities across regions, farms of different sizes, sociocultural groups, as well as in intrafamily distribution of food. To illustrate, nearly 26 per cent of the rural farming households, mainly sub-marginal and marginal farmers, were nutritionally deprived.

Nutritionists evaluate nutritional security in terms of adequacy of macro- and micro-nutrient with reference to clinical nutritional norms. NNMB surveys indicate that, in general, the consumption of cereals and millets in rural and tribal groups was comparable to balanced diets, but the intakes were low in urban slums. The consumption of micronutrient-rich foods, such as green leafy vegetables, other vegetables and fruits falls below recommended levels, particularly among the poorer population groups. These studies also show sub-standard consumption of green leafy vegetables, milk, fats and oils, sugar and jaggery in the diets of children. The deficit in mean energy intakes among children of preschool and school age was about 25 per cent, but intake of iron, vitamin A and riboflavin was higher across the board. In case of rural pregnant and nursing women, vitamins A, C, and B complex and calcium deficits were higher than those of energy and protein. Both these kinds of surveys, suggest the need to look beyond total production, availability, and average profiles.

Economists view food consumption as driven by self-provisioning, food habits and changes therein, education, incomes, prices, and availability. These and other interacting variables determine the food choices of households as consumers. Empirical studies on recent Indian data indicate that, on the average, calorie consumption has ceased to be income-responsive, implying a switch to non-calorie food with further income growth. At lower end of the income distribution, however, overcoming calorie deficiency remains a priority. All such analyses point to the need for proper targeting of food intervention programmes. Universal public distribution kind of programmes have outlived their utility.

Diversification

Driven by self-sufficiency motive, cropping patterns in India were locked to foodgrain production for a long time—a few regions devoting some resources for commercial crops

like cotton, sugarcane groundnut, etc. or plantation crops. As foodgrain production saturated markets, a trend towards diversification set in. Changes in pattern of domestic demand and, to some extent, export demand in the wake of trade liberalisation, resulted in changes in resource use and increasing diversification of enterprises. States which diversified the crop sector in a big way, have attained relatively higher growth in the net state domestic product of agricultural sector during the past two decades.

The factors that led to diversification of agriculture have varied, over time. During the first 15 years following the onset of Green Revolution, irrigation played the most important role, predominance of small holdings discouraged it. Abundant and cheap supply of electricity also fostered specialisation. Since early eighties, credit availability emerged as a significant determinant of diversification. Smaller farms continued to face rigidity in cropping patterns because of binding food production constraint. They diverted their attention to livestock enterprises. At the end of the millennium, there was consensus that diversification to higher value enterprises like, vegetables, fruits, other specialty crops, livestock products, fisheries, value-added agricultural products etc., was the new pathway for income growth in agricultural and rural sector. This would also help in bridging the quality gaps in terms of nutrition. Most of these enterprises were traditionally supplementary in nature and had become the domain of women. This bias adds to the strength of this paradigm.

Concerns and Constraints

- There is some apprehension that increasing diversification of land to non-food crops may affect basic food security adversely. Stagnation or decline in area under foodgrains would undermine our self-sufficiency in food. Some projections suggest massive imports of foodgrains, driven by rising food needs of a growing population and for animal consumption. A country of our size cannot reliably depend on the world market to meet these needs.
- This perception is countered by the scientific community. They contend that productivity levels are very low for most of the crops and animals. Exploitation of this yield gap through research can ease the pressure on land resources substantially. It was also pointed out that animal production systems in India are based on by-product and waste utilisation. Increased efficiency of this system would moderate demand for foodgrains for animal consumption.
- In fact, there have been instances of ecological degradation in the wake of growth in such enterprises. Brackishwater aquaculture, massive use of pesticides on fruits and vegetables, biodiversity erosion, salinisation and waterlogging in Punjab-Haryana and parts of Rajasthan, are examples sometimes alluded to, as consequences of diversification.
- These instances need to be carefully diagnosed because analysts also attribute these negative externalities to deficiencies in policies relating to pricing, investments, etc. The real challenge would be to achieve such intensification in an ecologically benign manner, through appropriate policies and technologies.

- High post-harvest losses significantly undermine the prospects of diversification, particularly through high-value perishables, like horticultural and livestock produce. Losses through inefficient handling, transport, storage etc., rise exponentially as scale of output expands. There are increasing instances of total loss in the fields as farmers cannot even cover harvest costs due to crash in prices at harvest time. We need to strengthen processes, institutions and R&D efforts to tackle these constraints. The priority accorded to agroprocessing industries is a welcome policy initiative in this direction.
- Also important are infrastructural constraints. Most of the commodities in the new diversification basket were traditionally confined to local markets in unprocessed form and in small volumes. Facilities like cool chains, refrigerated transport, modern abattoirs, processing plants and other infrastructure were not relevant. Now the market is global and weak support in infrastructure restricts growth prospects. Similar constraints emerge in institutional infrastructure. Extension, market, credit, information—all have focused on food and commercial enterprises of major importance. In the present context, these create bottlenecks.
- There is evidence to show that because of binding food needs, small farmers are able to diversify only to a limited extent. This implies that as this process accelerates, such farms will lose ground further in terms of income growth. There are special programmes like IRDP which provide support for diversification in respect of small and poor farmers, but more needs to be done. Increase in productivity of their basic staples would provide a significant leeway for incorporation of other enterprises. Small producers also face scale related constraints—the size of their output is small and incomeenhancing options like access to superior markets, value addition, storage, etc. become non-viable. New institutional arrangements are necessary if this handicap is to be overcome.
- There is also an apprehension that shift from traditional foods many of which are rich in vitamins and micronutrients, would result in decline in nutritional quality of diets. Substitution of millets by wheat and rice, for example, does not augur well for poor consumers who cannot afford supplementary alternatives. Fall in consumption of pulses is also a cause for concern. This nutritionally regressive substitution in production patterns arises from technology and price changes which affect profitability and incomes of producers. Lack of nutritional awareness leads to undervaluation of nutritive food by consumers and in the marketplace. Nutrition scientists highlight such dimensions of commercially-driven diversification and plead for investment in nutrition education.

Conclusions and Recommendations

Shifting agricultural resources to higher-valued options is the new strategy for agricultural development. Buoyancy in domestic demand for such commodities has generated congenial incentive environment for such transition and the process has begun. Good export prospects reinforce this trend. Non-conventional crops like aromatic and medicinal plants, floriculture, etc., figure importantly in this strategy but the major impetus comes from horticulture, livestock, dairy poultry, fisheries, etc., which have traditionally been minor constituents of Indian diets. The nutritional implications are obvious. Growth in

incomes has spurred demand for these commodities even as foodgrain consumption stabilises, and producers have responded to such market signals.

General inadequacy of Indian diets in terms of micronutrients and vitamins is well established. For the poor, access to even macronutrients is constrained. As overall well-being improves with future growth in incomes, special attention will have to be paid to nutritional aspects. Salient recommendations relating to diversification and nutrition emanating from the symposium are summarised below.

1. *Policy Imperatives*

- Thrust on raising productivity of foodgrains must remain a central feature of agricultural policy. Only through this route can the twin objectives of self-reliance and rapid rural income growth be realised. It will enable unlocking of resources which would otherwise remain tied to less remunerative enterprises.
- Diversification of production base of Indian agriculture requires massive investments in rural and other infrastructure. Apart from roads, electricity, irrigation, greater emphasis on storage, specialised handling and transport, assembling, wholesale and retail markets, effective market intelligence, etc. will be needed.
- The emerging economic regime requires dismantling all distortions in input-output pricing. These impart incorrect price signals and farmers are distracted from efficient production patterns. Massive irrigation subsidy and its effect on cropping patterns is an illustration. The structure of tariffs is also a case in point.
- A reorientation of the institutional support for agriculture will be necessary for exploitation of new opportunities by small producers who constitute more than 80 per cent of the farming households. Input-output marketing, value addition and processing, credit, insurance, R&D, extension, etc. need to shift from foodgrain and large-farm-based approaches to a more holistic paradigm. Leasing and tenancy reforms will be necessary.
- Agroprocessing investments must move to the countryside where production is concentrated. While technology and quality considerations may necessitate foreign investments in this sector, mechanisms will have to be developed to ensure effective small farm participation.
- A task of this magnitude and complexity will necessitate a dominant role for the private sector. The public sector will need to withdraw from some areas and strengthen others, like R&D, information, natural resource management, regulatory processes and so on. A set of policies to provide incentives to the private sector will be necessary.
- A large population will continue to be economically and nutritionally deprived. People below the poverty line, women and children, particularly in rural areas, and urban slums, will need strong safety nets. Weaknesses in existing programmes have been well identified and are being addressed. These need to be pursued more vigorously.

- These challenges are beyond the competence and resources of governments. It will be necessary to involve people in planning and executing decentralised initiatives. Nongovernmental organisations, self-help groups, cooperatives, *panchayats* will need to play a greater role and these must be strengthened.

2. *Nutrition*

- Nutrition education must be made part of regular curricula in schools. Sustained drives using mass media, particularly in rural areas and urban slums are necessary to create greater awareness.
- Programmes like homestead gardening, urban gardening, household preservation and enrichment of food, etc. must be actively supported. Health and hygiene, sanitation, etc. make significant contributions to nutritional well-being and should be accorded greater priority.
- Food enrichment, fortification strategies need to be supported. Assessment and incorporation of indigenous ingredients offer considerable opportunities and should be exploited.
- National nutrition monitoring effort must be further strengthened and focused on target themes and populations.

3. *R&D*

- Continuous increase in productivity of agricultural enterprises—crops, animals, fish, is essential. This would ease the subsistence pressure on natural resources, relating them to commercial enterprises. The research system must continue to accord high priority to food crops, particularly those which are of importance to the rural poor and tribal farmers.
- Advances in modern sciences, particularly biotechnology, offer exciting opportunities for incorporation of marketable and nutritional qualities in food crops of various kinds. Even as research on genetically modified organisms is accelerated, proper testing and safeguard procedures need to be put in place. The point to note is that this area of research can tackle several constraints inhibiting yield, quality, and nutrition.
- More resources should be allocated for nutrition research. There are basic as well as applied research issues relating to indigenous food, nutraceuticals, formulations, food safety, standards, etc. which need to be investigated. There is enormous variability in food habits, tastes and preference products etc. across the country and these must be captured and analysed.
- Unmindful pursuit of market opportunities often exacerbates pressure on natural resources and ecology. Safeguarding future production potential and ecological balance should be high priority for research.

- Wide diversity in growing conditions implies a wide range of options for diversification and income growth. This is a big strength for Indian agriculture, but this necessitates decentralised research approaches which maximise comparative advantage of different regions. A careful regional prioritisation of research is called for.
- Preventing post-harvest losses has emerged as a critical element, and so has value addition and processing. Known technological options in these areas are highly capital intensive and not really appropriate for small scale operations which are characteristic of the Indian rural scene. The research system faces this unique challenge of developing efficient small scale technologies which will benefit small scale rural producers and entrepreneurs.
- Finally, success of the diversification strategy would demand research on a number of socioeconomic parameters like, market structure, conduct and performance, input-output demand, comparative cost and returns, price analysis, organising producers' and entrepreneurs' private sector role, etc. While the research system is gearing up to meet production research challenges, this area must also receive attention.