4. SUSTAINABLE FOOD PRODUCTION TO MEET NUTRITIONAL NEEDS

Nutrition scientist view agricultural produce as a major input required for improving dietary intake and nutritional status of the individuals. However, the farmers have to be assured of returns for their investment if they are to meet the nutritionists' prescription on what to grow to meet the nutritional need of the population. Whenever steps have been taken to ensure that there is congruence between the economic policies especially those related to agriculture and nutritional perspectives, the response of the farming community has been excellent and resulted in improvement in nutritional status of the population. The green revolution in India and massive increase in production of rice and wheat are the best examples of what could be achieved if economists and nutrition scientist pull together. The country has achieved self-sufficiency in food grains to meet the needs of the growing population; and adequate buffer stocks within a relatively short time; this resulted in improved access to food for poorer segments of the population and reduction in under nutrition.

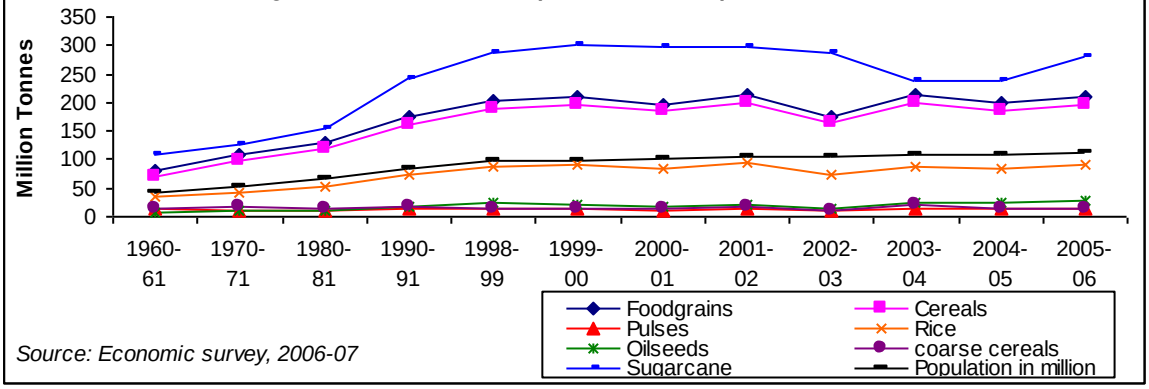
Agriculture development in the country during the last five decades could be divided into the following phases:

- the expansion of net sown area (NSA), irrigated area, development of rural infrastructure and land reforms;
- high yielding dwarf varieties, agricultural inputs like fertilisers, pesticides and improved crop production technologies which ushered in the Green Revolution';
- minimum support prices (MSP) and procurement of agricultural commodities , food grains storage and distribution system expanded at the national level;
- the thrust on liberalisation and globalization.

The impact of these on food production is reviewed in the following pages.

Food production

Figure 4.1: Time trends in production of important food items



Source: Economic survey, 2006-07

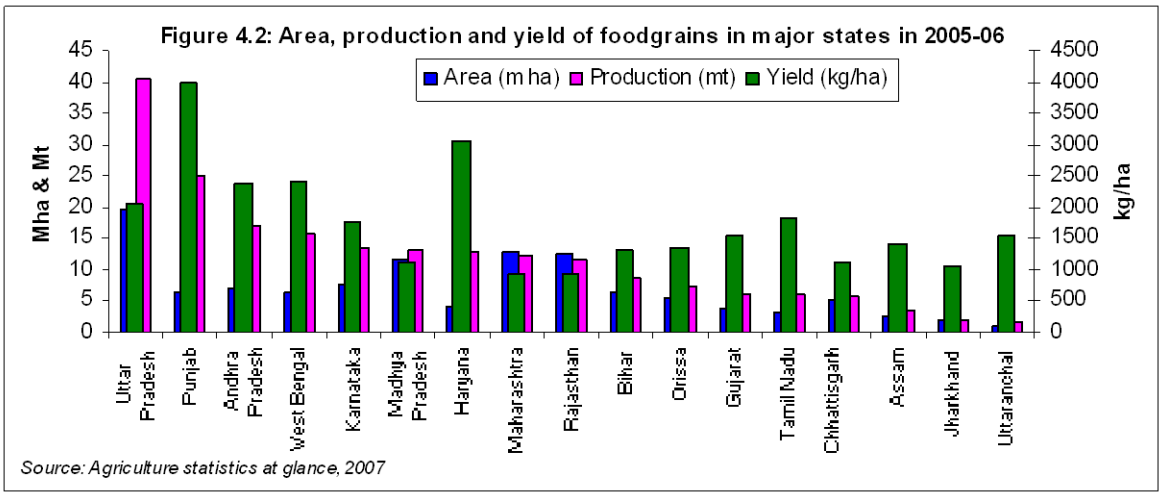
The time trends in production of major crops are given in Annexure 4.1. Agricultural production increased nearly threefold from 1960–61 to 1998–99

(Figure 4.1). The century ended with the country's output of food grains crossing 200 million tonnes, a fourfold increase since 1960–61, mainly due to the success of the green revolution since the 1970s. Over years most farmers have shifted to rice and wheat cultivation because of the MSP offered by the Government. The coarse grain production has remained stagnant. Although the area under cultivation with food grains has remained virtually constant since 1970–71, the yield has increased by 65 %. India which had to import food grains for some time after independence, but now it has emerged as a marginal exporter of food grains (Ministry of Finance, 2000). Agriculture contributes nearly one-fourth of the GDP (Reserve Bank of India, 1999) and provides a livelihood to about two-thirds of all workers in the country (Central Statistical Organisation, 1999). Although the %age of land cultivated with food crops that is irrigated increased from 24 % in 1970–71 to 41 % in 1996–97, the performance of Indian agriculture still largely depends on monsoon rains. In spite of a fourfold increase in food production since the early fifties, daily per capita net availability of food grains has increased by only 18 %, from 395 grams to 467 grams per day (Ministry of Finance, 2000). During the 1990s the growth rate of foodgrains production declined to 1.9 % per annum from 3.5 % per annum during 1980s. Similarly the growth rate of productivity in food grains decelerated to 1.3 % % as compared to 3.3 % per annum during the 1980s. In terms of productivity the country lags behind others. Production under various crops over the last five decades and the net availability of cereals and pulses over the period is shown in Annexure 4.1 and Annexure 4.2.

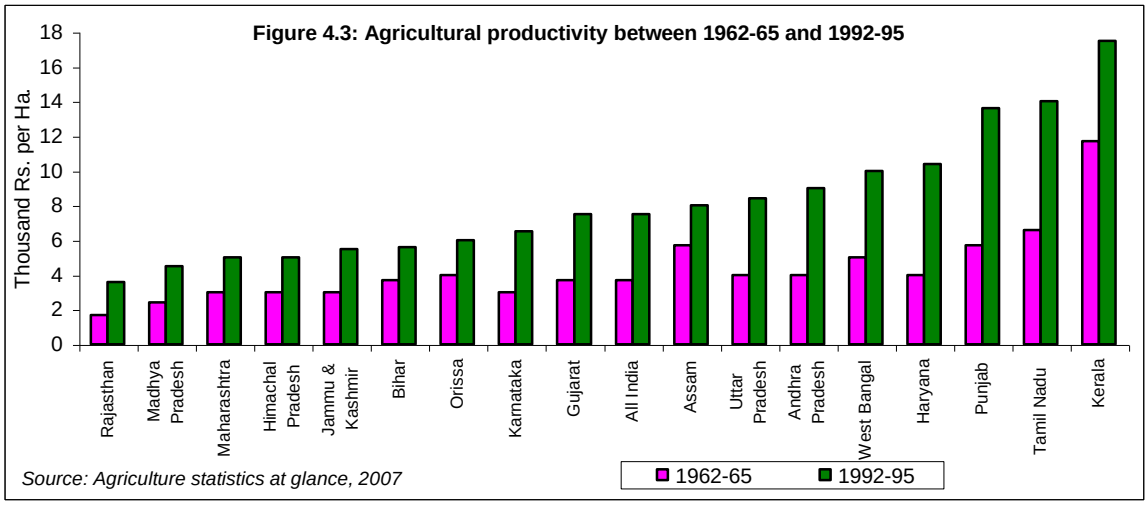
The production of kharif food grains during 2006-07 is estimated at 209.2 million tonnes (second advance estimates) which is higher than 208.6 million tones estimated during 2005-06. The production of rice is estimated at 90.1 million tonnes compared to 91.8 million tonnes during the previous year. The production of wheat is estimated at 72.5 million tonnes which is higher than the previous year's production of 69.3 million tonnes. The production of coarse cereals is estimated at 32 million tonnes, which is lower than the previous year's production of 34 million tonnes. Sugarcane production is estimated to be higher at 315.5 million tonnes (first advance estimates), as against 281.2 million tonnes during the previous year.

It is a matter of concern that massive improvement in food grain availability, substantial decline in cost of cereals, improved access to subsidized food grains through Targeted Public Distribution System have not resulted in elimination of hunger or reduction in under-nutrition especially in vulnerable groups.

The production of important crops in three largest food grain producing states is given in Annexure 4.3. Uttar Pradesh, Punjab and Haryana are the major producers of food grains in 2004-05. Rajasthan, Madhya Pradesh and Gujarat are oilseeds producing states; major sugarcane producing states are Uttar Pradesh, Maharashtra and TamilNadu. Data on area under cultivation, production and yield is given in major states in Figure 4.2. Almost all states



produce food grains. Punjab and Uttar Pradesh rank highest in production of food grains. Punjab and Haryana top the yield of food grains. It is obvious that there are huge differences not only in area under cultivation but also in yield between states. Agricultural productivity in different states is given in Figure 4.3. Improvement in productivity in large states like UP will have a major impact on food grain availability in the country. As there is not such scope in terms of increase in area under cultivation, efforts to increase productivity has to be given priority over the next decade.



The very success of Green Revolution brought about some major problems. Many states have attempted to increase production through subsidies on inputs such as power, water and fertilizers, rather than by building new capital assets in irrigation and power. Unsustainable practices like excessive use of water together with imbalanced use of fertilizers especially in the Green Revolution areas of northern and northwestern parts of the country have adversely affected soil health and environment. Though the consumption of pesticides seems to have declined, because of the propagation of the Integrated Pest Management (IPM) approach and the increasing awareness about the hazards of pesticides,

the availability of quality pesticides and pesticide residues in foodstuffs, remained a matter of concern. Many of the erstwhile high producing states are experiencing Green Revolution fatigue. Very little attention is being paid to achieve integrated farming systems that will ensure sustainable evergreen revolution essential for appropriate dietary diversification to achieve nutrition security (Text Box 4.1& 4.2).

Text Box 4.1: Land

- Land available for food grain cultivation has been dropping steadily and now is 120 million hectare.
- Fragmented holdings of land- the average size of holdings decline from 2.63 ha in 1960-61 to 1.06 in 2002-03, making it difficult for farmers to come out of the poverty trap
- Restrictive and outdated land laws that do not give farmers flexibility
- Overdependence on agriculture for employment due to slow growth of non farm sector in villages.

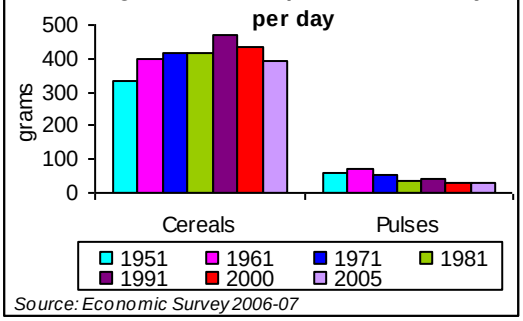
Text Box 4.2: Yield

- No new technological breakthrough in terms of high yielding varieties for food grain crops.
- Soil fatigue due to over exploitation of nutrients and organic matter in intensive cropping areas.
- Nutrient imbalance due to use of improper combination of fertilizers
- Non availability of quality seeds resulting in low seed replacement rates.
- Inadequate or poor harvest management infrastructure at the farm level.

To meet all the nutritional needs of the growing population, the country will have to produce an extra five million tonnes of food grains annually and increase the production of livestock, fish and horticultural products. This has to be achieved in the face of shrinking arable land and farm size, low productivity, growing regional disparities in productivity and depletion of the natural resource base. Appropriate steps have to be taken to minimise the potential adverse consequences of globalisation on domestic production, employment and price stability of food commodities. In India the productivity has been quite low. The challenge is to take appropriate steps to improve productivity in all the states. The low productivity can also be viewed as an opportunity which can readily help the country to increase production without worrying about the country's inability to expand the area under cultivation.

Cereal production

Figure 4.4: Per capita net availability per day

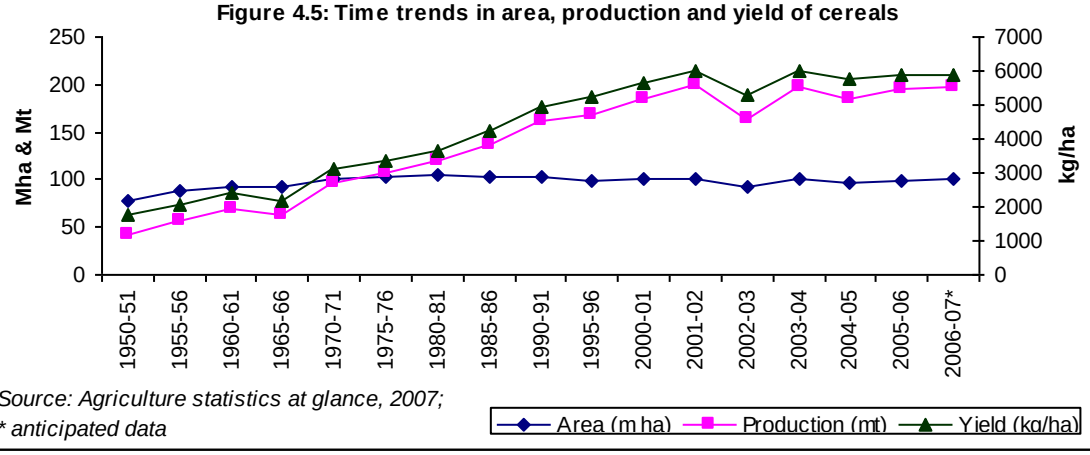


Source: Economic Survey 2006-07

The country has been producing adequate cereals to meet the needs of the population since mid seventies. Over the last five decades per capita net availability has been showing improvement and by 1991 it was sufficient to meet the RDA for cereals (Figure 4.4). The production of cereals has increased tremendously in last five decades though the area under the cereal production has not increased much Figure 4.5.

Annexure 4.3 gives information on production of various cereals in largest cereal producing states. West Bengal, Andhra Pradesh and Uttar Pradesh are the largest rice producing states. Uttar Pradesh, Punjab and Haryana are largest producers of wheat in the country; coarse cereals are mainly produced in Maharashtra, Karnataka and Rajasthan.

Figure 4.5: Time trends in area, production and yield of cereals



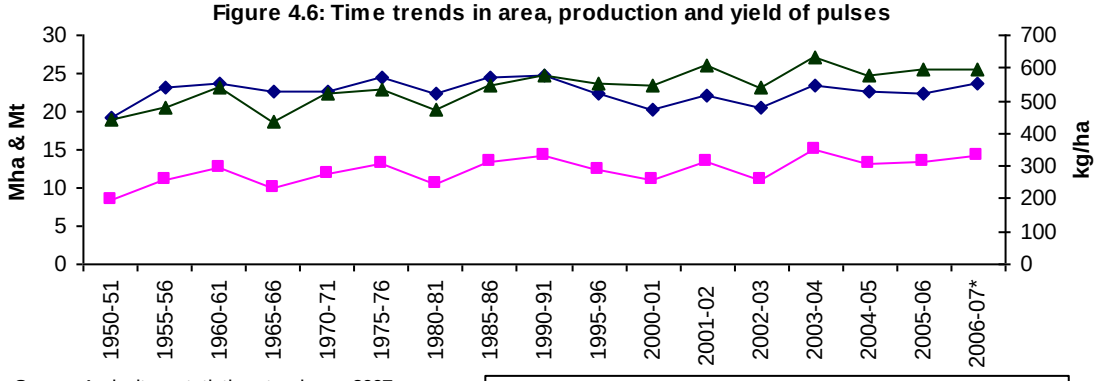
Source: Agriculture statistics at glance, 2007;
** anticipated data*

Inputs needed to achieve a sustainable increase in food grain production to meet the needs of the growing population have to be provided. Locally produced and procured coarse grains made available through the Targeted Public Distribution System (TPDS) at a subsidized rate may substantially bring down the subsidy cost without any reduction in calories provided. This will also improve targeting as only the most needy are likely to buy these coarse grains. Millets are rich in minerals and micronutrients and hence increased consumption will improve the intake of these vital nutrients by the poor. Some states have taken steps to include coarse grains under the TPDS. This is a welcome step and may result in increased local production and consumption of the coarse grains.

Pulse production

India is the key player with 25% share in the global pulse basket from an area of about 32%, the annual production being 13.63 million tonnes in latest triennium.

Figure 4.6: Time trends in area, production and yield of pulses

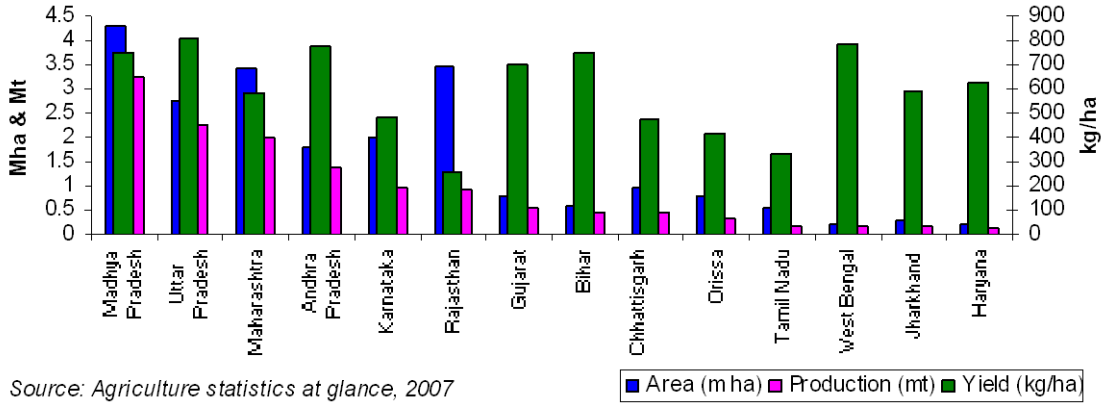


Source: Agriculture statistics at a glance, 2007;
* anticipated data

The important pulse producing states are Madhya Pradesh, Uttar Pradesh, Maharashtra, Rajasthan, Karnataka and Andhra Pradesh, which together account for 75% production. In the last five decades, there has been a progressive decline in per capita availability of pulses (Figure 4.4) and pulse consumption, especially among the poorer segments of the population. This is due to stagnant production and consequent rising cost of pulses. This trend has to be reversed.

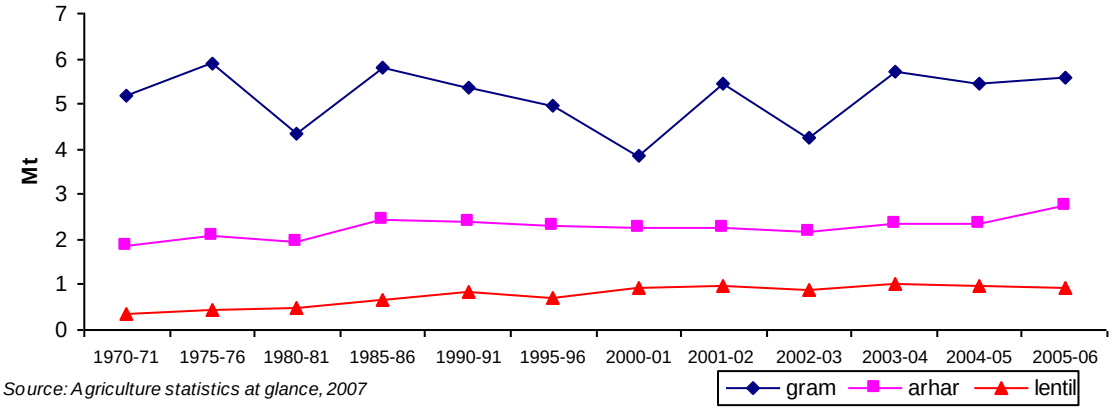
Time trends in area, production and yield of pulses is shown in Figure 4.6. The source of growth varied in different periods. Area expansion was the major factor for growth during 1951-67; the yield improvement has been the key element in the post-All India Coordinated Pulses Improvement Programme (AICPIP) period (1967-2002). National pulse production has increased from 10.6 million tonnes in 1980-82 to 13.4 million tonnes in 2005-06, registering a growth of 1.7% annually. However, the share of pulses in the total food grain production has declined from 15.8% in 1951-55 to 6.3% in 2005-06.

Figure 4.7: Area, production and yield of pulses in major states in 2005-06



Source: Agriculture statistics at glance, 2007

Figure 4.8: Time trends in production of various pulses



Source: Agriculture statistics at glance, 2007

Interstate differences in area, production and yield of pulses in 2005-06 are shown in Figure 4.7. Madhya Pradesh, Uttar Pradesh and Maharashtra are the largest producers of pulses. The production of gram is highest but has not

changed over the years. However, over the years there has been some increase in production of *arhar* and lentil (Figure 4.8).

In post-Green Revolution period, the per capita availability of pulses has declined sharply in the country, as growth in pulse production did not keep pace with the population growth. The country has experienced progressive decline in per capita availability of pulses from 69 g in 1961 to 32 g in 2005. Because of the shortfall in national production, the country has been importing pulses. During 2001-02, the country imported 21.8 lakh tonnes of pulses valued at Rs 3155.7 crore (Table 4.1).

Table 4.1: Import and export of pulses in India

Year	Import		Export	
	Quantity (000' tonnes)	Value(Rs crores)	Quantity (000' tonnes)	Value (Rs crore)
1990-91	791.95	473.24	-	-
1995-96	490.75	685.57	61.36	131.91
1999-2000	250.77	354.69	194.18	419.56
2000-2001	349.84	498.47	244.08	537.08
2001-2002	2177.13	3155.66	159.55	366.18

Source: Indian Horticulture Production at a glance, 2004-05

It is estimated that to meet the needs of the growing population the requirement in pulses will go up to 19.6 million tonnes by 2007, and 21.3 million tonnes by 2012. To make the nation pulse sufficient there is a need to increase the area under pulse cultivation and improve productivity. A proactive strategy from researchers, planners, policy makers, extension workers, market forces and farmers aiming not only at boosting the per unit productivity of land but also at reduction in the production costs is needed to improve availability and affordability of pulses.

Lack of assured market is one factor responsible for the stagnation in pulse production. Due to serious problem of stored grain pest infestation and lack of storage facilities, farmers are compelled to sell their produce to middlemen at low price. The minimum support price announced by the Government does not benefit farmers in absence of procurement mechanism. Moreover, all pulse crops are not covered under the minimum support price. Therefore, procurement policy for pulses needs to be strengthened immediately and reasonable buffer stock needs to be built up to meet the contingencies. Appropriate market intervention and promotion of post harvest technology are also necessary to encourage farmers to invest more in pulses production. Distribution of pulses through TPDS may improve access to pulses and help in stabilisation of cost of pulses.

Horticultural production

Vast areas of India have tropical and agro-climatic conditions which are well suited for cultivation of horticulture and plantation crops. Horticulture is an ideal crop for marginal and degraded lands. Besides, providing nutritional and livelihood security and helping poverty alleviation and employment generation, this sub-sector can sustain a large number of agro-Industries, which can

generate huge additional non-farming employment opportunities. These factors have led to greater area being brought under horticulture and consequent increase in production of fruits and vegetables. Horticultural products provide higher yield per hectare and the sale price is also higher. The horticulture sector contributes about 24.5% towards agriculture GDP from only about 8% of the cultivated area. It is only recently that a reasonably reliable database for horticultural products has become available. The estimated area and production of some of the major horticultural crops in recent years is given in Table 4.2.

Table 4.2: Estimated area and production of fruits and vegetables in 2004-05

Fruits	Area (000'ha)	Production (000;MT)	Vegetables	Area (000'ha)	Production (000;MT)
Apple	230.7	1739.0	Brinjal	530.32	8703.8
Banana	529.7	16225.3	cabbage	290.29	6147.7
Citrus	712.4	5996.9	cauliflower	238.17	4507.9
Grape	60.2	1546.3	okra	358.31	3524.9
Guava	162.0	1685.6	Peas	276.72	1971.8
Litchi	60.0	368.6	Tomato	497.65	8637.7
Mango	1961.9	11605.2	Onion	593.94	7515.4
Papaya	73.0	2568.2	Potato	1542.3	29189
Pineapple	81.2	1229.4	sweet potato	136.46	1211
Pomegranate	112.5	792.5	tapoica	281.29	7900.8
Sapota	133.1	1060.2	Others	2010.2	22124
others	847.0	4476.7	All vegetables	6755.6	101433
All fruits	4963.8	49294.8			

Source: Indian Horticulture Production at a glance, 2004-05

India has identified horticultural crops as a means of diversification for making agriculture more profitable through efficient land use, optimum utilization of natural resources (soil, water and environment) and creating skilled employment for rural masses, especially women folk. However, if these efforts are to succeed some of the concerns of the farmers have to be addressed. The shelf life of food grains is over 3 years or more but shelf life fruits and vegetables ranges from a week to 3 months. Currently hardly 1 % of over 140 million tonnes of fruits and vegetables produced in the country goes through the processing route. Losses during packaging and transport are estimated to be about 30% and when coupled with poor off take, it can spell major economic disaster for the farmers. It is therefore imperative that creation of essential infrastructure for preservation, cold storage, refrigerated transportation, rapid transit, grading, processing, packaging and quality control get the necessary investment to enable the horticultural sector to achieve its full economic potential. The Tenth Plan has emphasized the need for Nutrition Security with rapid increase in dietary diversification. With the increasing economic growth and emergence of a large middle class, which is aware of the importance of vegetable and fruit intake in their diet, it is expected that the demand for fruits and vegetables over the next few years will show a steep rise. This must be met through increased production of these in the country.

Efforts are on to encourage private investment in hi-tech horticulture with micro-propagation, protected cultivation, drip irrigation, and integrated nutrient and pest management besides making use of latest post-harvest technology particularly in

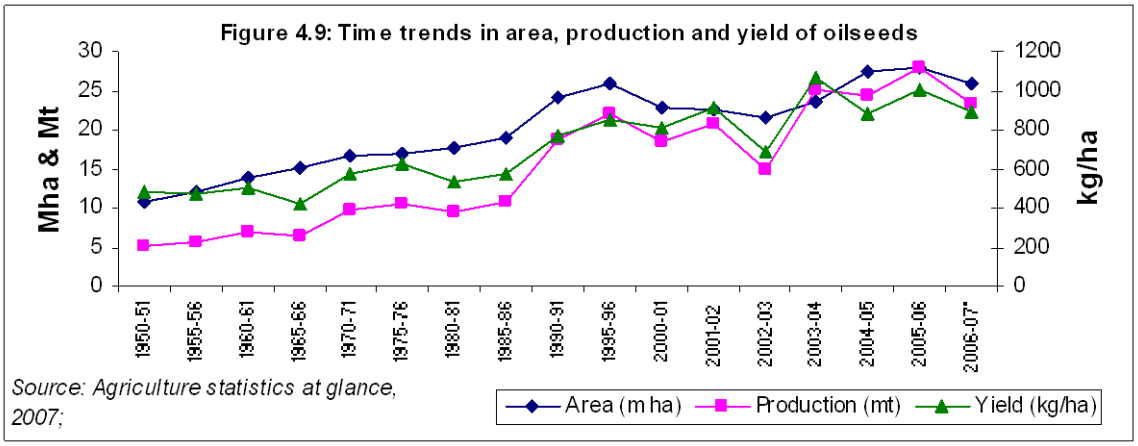
the case of perishable commodities. As a result, horticulture crop production has begun to move from rural confines to commercial ventures and has attracted young entrepreneurs, since it has proved to be intellectually satisfying and economically rewarding. This will not only help in retaining educated youth in the farm sector but would also enable the micro-nutrient needs of the population to be met through a sustainable food-based approach. The processing, storage and transportation for horticultural products in a manner that there is no glut and distress sale, will make their production economically attractive to farmers and improve availability to the consumers.

The Ministry of Food Processing is setting up food parks in different parts of the country. The idea behind setting up of food parks is to enable small and medium entrepreneurs find access to capital intensive facilities, such as cold storage, warehouse, quality control labs and effluent treatment plants. Development of such facilities is expected to make the food processing units in the food parks economical and competitive and may improve their market accessibility.

In spite of being a major vegetable and fruit producing country in the world per capita consumption of these in India is very low. Consumption of adequate quantities of vegetables, especially green leafy ones, is essential for meeting the dietary requirement of vital micronutrients. Besides, vegetables also provide several phytochemicals and fibre essential for health. At present, there is insufficient focus on the cultivation and marketing of low-cost, locally-acceptable green leafy vegetables, yellow vegetables and fruits. As a result, these vegetables are not available at affordable cost throughout the year. Health and nutrition education emphasising the importance of consuming these inexpensive but rich sources of micronutrients will not result in any change in food habits unless the horticultural resources in the country are harnessed and managed effectively to meet the growing needs of the people at an affordable cost.

Oilseeds

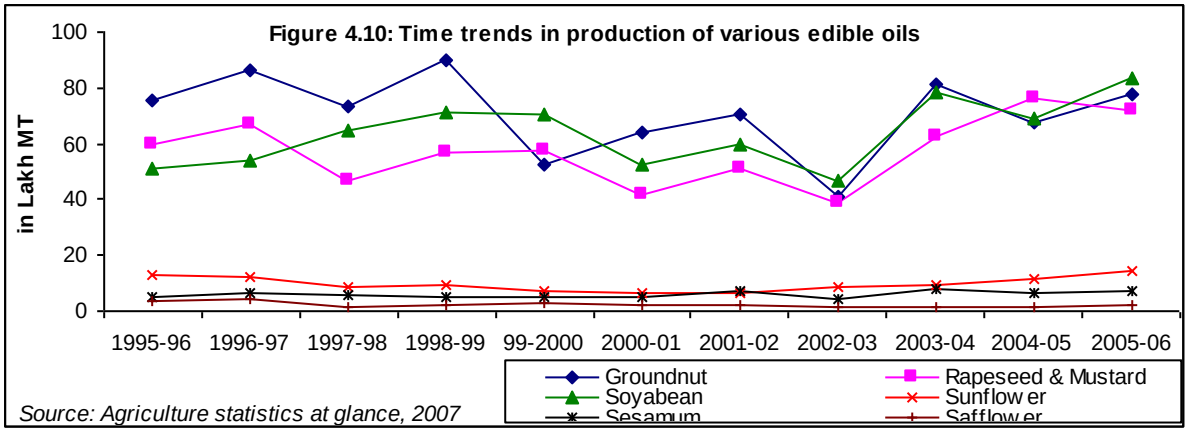
In India vegetable oils are used mainly for cooking. Groundnut, sesame, coconut



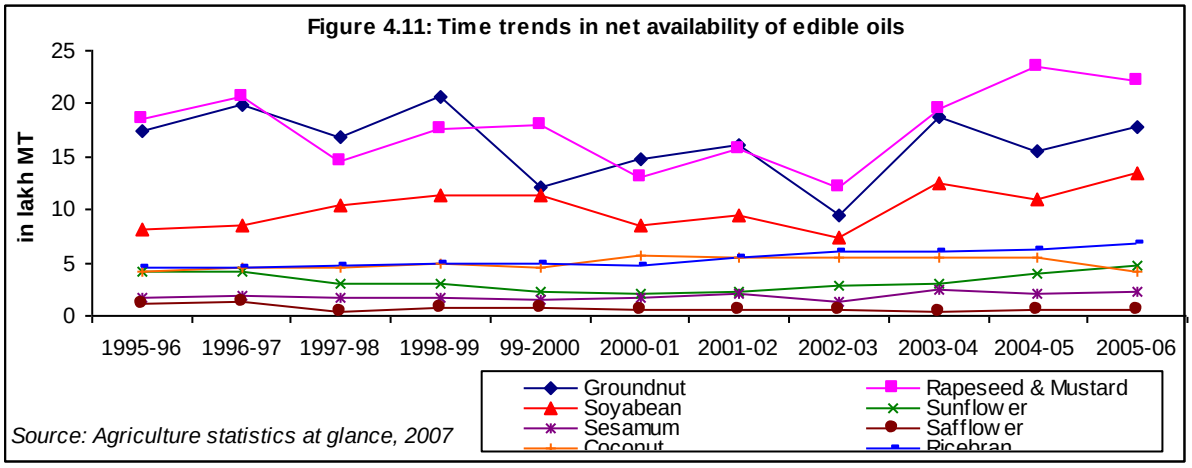
Source: Agriculture statistics at glance, 2007;

and mustard oils are used traditionally in India. Oilseeds production has increased over the last five decades (Figure 4.9) – but the increase is not sufficient to meet the demand; the country therefore continues to import oil. National Mission on Oilseeds and Pulses was formed in 1986 to give focused thrust to oilseed production in the country and improve availability of oil. A major effort was to introduce the newer oilseeds/ oils in the Indian market. Over the last two decades soyabean, sunflower, safflower, corn, rice bran oils have been introduced and have found acceptance.

Review of the edible oil production in the last decades (Figure 4.10, 4.11) shows that there was not much change in production of groundnut oilseeds. Mustard and rapeseed production has increased in the last ten years; there has been tremendous increase in production of soyabean which was introduced as the newer oilseed. There was not much change in production of sunflower, safflower and sesame seeds in last ten years. Net availability of ricebran, soya, mustard



Source: Agriculture statistics at glance, 2007



Source: Agriculture statistics at glance, 2007

oils has increased over the last ten years (Figure 4.11).

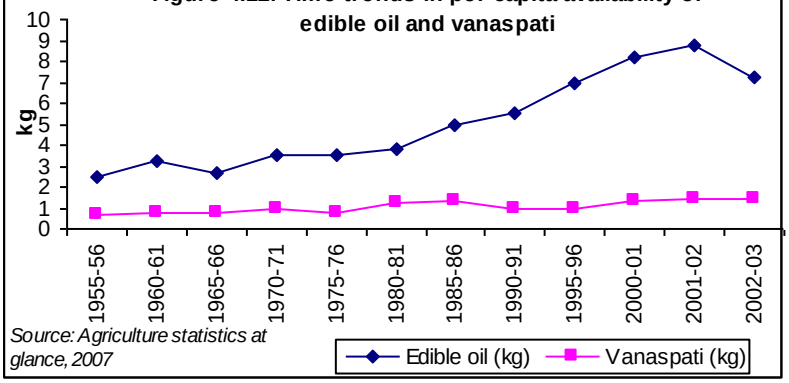
Trans-fats are a popular component in various food products and widely used by all - from housewives to food product manufacturers. The fast food industries use trans-fats instead of ghee because it is inexpensive. Trans-fats are found in margarine, crackers, candies, cookies, snack foods, baked goods, and other

processed foods. Lack of time for cooking due to busy lifestyles has resulted in many persons from all income group consuming ready to eat foods from various eateries; many of the products in these eateries are fried in trans-fat to reduce rancidity and improve shelf life and this results in people inadvertently consuming large quantities of trans-fatty acids.

Trans-fats are manufactured from hydrogenation of vegetable oils. During the hydrogenation process, the oils loose their natural content of antioxidants like carotenes, tocopherol and tocotrienols. Trans-fats adversely affect lipoprotein metabolism and are hypercholesterolemic. It is reported that trans-fatty acids attack and weaken cell membranes reducing the efficiency of the immune system, making individuals more vulnerable to carcinogens. Research studies have unequivocally demonstrated that trans-fat consumption increases the risk of non-communicable diseases, especially coronary heart disease. The World Health Organization (WHO) in 2003 recommended that trans-fat use be limited to less than 1% of overall energy intake.

Currently, in India there are no specific guidelines for regulating use of trans-fats. Government of India has taken the first step in the regulation of transfatty acid use by making it mandatory from September 2007 to indicate the amount of transfatty acids in the label of all manaufactured food products.The annual production of *vanaspati* (fully or partially hydrogenated vegetable cooking oil) in India is 5% of total edible oil. The consumption of *vanaspati* has declined over the years as a proportion of total edible oils consumption, even though awareness on the dangers of trans-fats remains very low (Figure 4.12). There is an urgent need to improve awareness among the consumers and producers. Simultaneously the government may have to impose stringent rules and regulations to reduce or even ban trans-fats in food products. A combination of both awareness and regulations against usage or production of trans fat would perhaps help rapid in reduction and elimination of use of trans fats.

Figure 4.12: Time trends in per capita availability of edible oil and vanaspati



Source: Agriculture statistics at glance, 2007

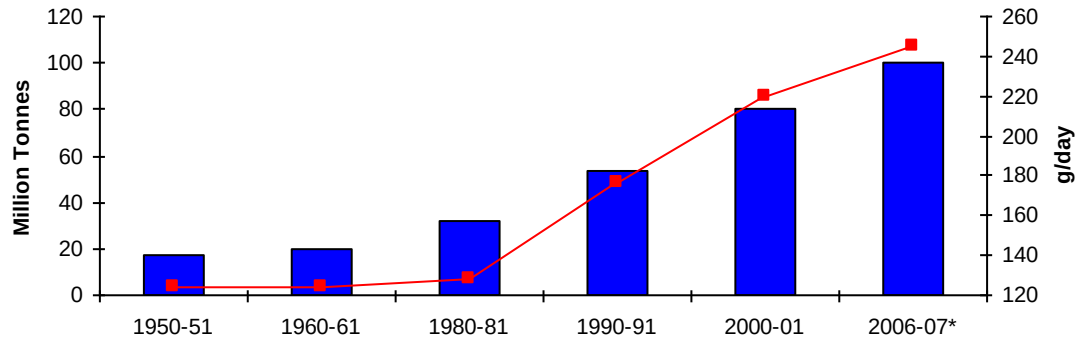
Animal Products

Milk Production

Time trends in milk production and percapita availability of milk since independence is given in Figure 4.13. India's success in improving milk production through cooperative movements over the last three decades has been

globally recognized. Production of milk has gone up over five folds since

Figure 4.13: Estimates of production and percapita availability of milk- All India



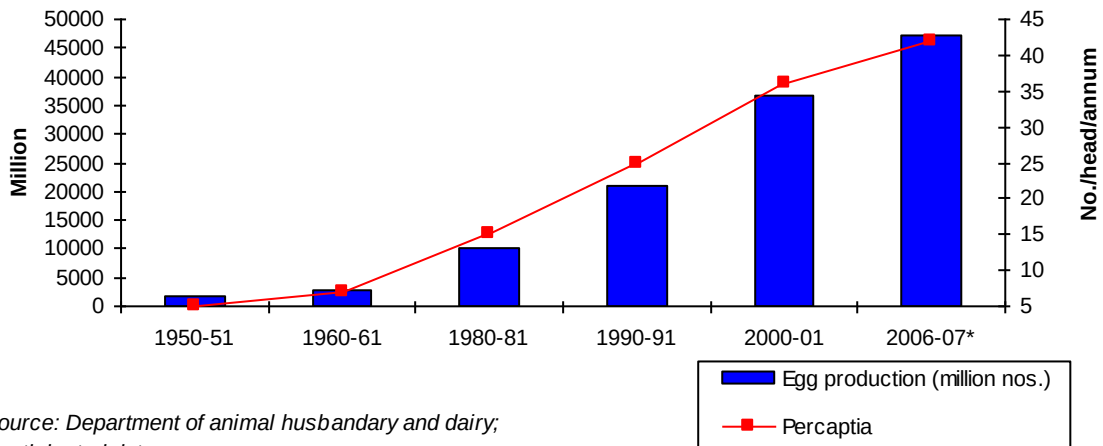
Source: Department of animal husbandary and dairy;
** anticipated data*

independence. There has been a steep increase in percapita availability of milk. To India's large vegetarian population milk and milk products are the only source of animal protein. Milk is expensive and milk intake among the poorer segment of population continues to be low. Consumption of milk and milk products in high income group both in urban and rural areas has increased.

Poultry

Estimate of egg production and percapita availability of eggs in the country over the last five decades is shown in Figure 4.14. There has been a steep increase in

Figure 4.14: Estimates of production and percapita availability of egg-All India



Source: Department of animal husbandary and dairy;
** anticipated data*

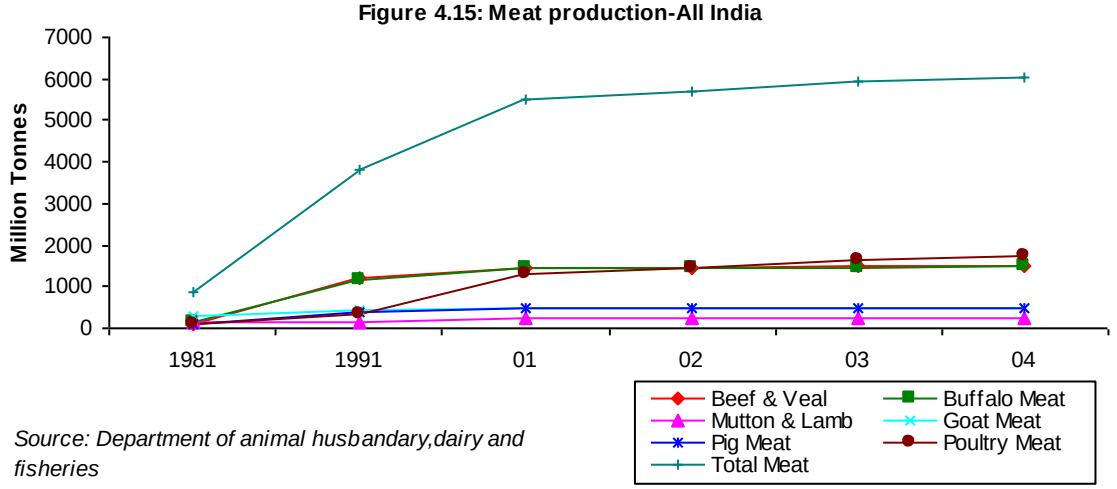
egg production in the last two decades. With an output of over 45 billion eggs in 2006-07 India ranks among the top six egg producing countries in the world.

India among the top five chicken meat producing countries in the world: around 1.7 million tonnes of chicken meat was produced in 2004. Both chicken and egg are expensive and hence consumption of these is more common among the affluent segments of population.

Meat products

Information on meat production in country since 1981 is given in Figure 4.15. Available data suggest that there has been a steep increase in meat production between 1981 and 2001; thereafter the increase in meat production has slowed down.

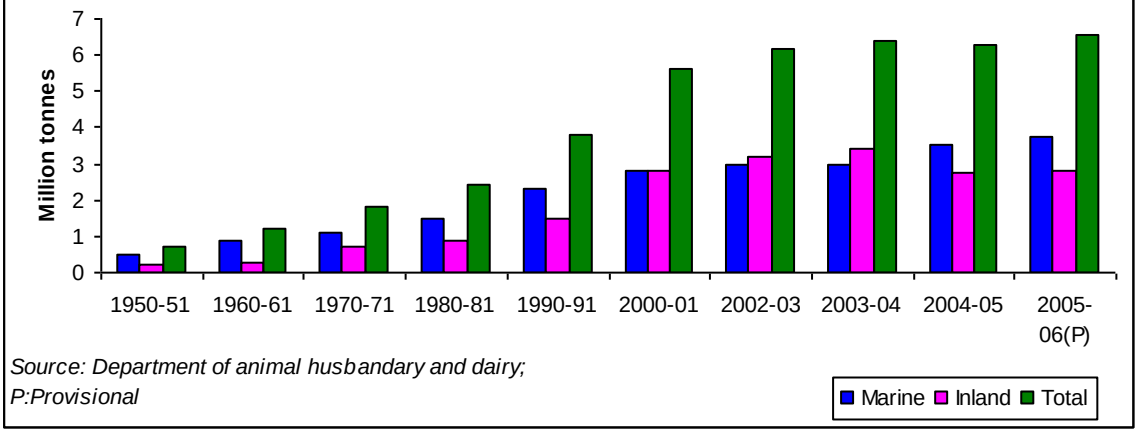
Figure 4.15: Meat production-All India



Source: Department of animal husbandary,dairy and fisheries

Marine products

Figure 4.16: Production of marine products



Source: Department of animal husbandary and dairy; P:Provisional

Estimated production of marine products over the last five decades is shown in Figure 4.16. There has been a steep increase in fish production in the last decade. India is currently the third largest producer of marine fish and second

largest producer of inland fish in the world. In addition to the catering to the needs of India's large population, fisheries sector is a major foreign exchange earner and provides livelihood to over 10 million people.

Consumption of animal products

In India percapita availability and consumption of meat, fish, milk and milk products and eggs is quite low. Current consumption levels of these products and the per capita deficit as compared to ICMR guidelines are shown in Table 4.3. The animal products are expensive and are consumed mainly by the middle and high income group; even among these segments they are not consumed on a daily basis or in large quantity because of high cost and ready availability of nutritious and tasty vegetables at a substantially lower cost.

Table 4.3: Per capita availability and deficit

Food Items	Per capita availability	ICMR dietary guidelines for Indians	Per capita deficit
Milk	216 g**/day	300 ml*/day	34 g/day
Egg	30 eggs/annum	180 eggs/annum	150 eggs/annum
Meat	3.24 kg/annum	10.95 kg/annum	7.71 kg/annum

* *millilitre* ** *grams*
Source: Tenth five year plan 2002-07

Industrial level production has been the traditional method used for increasing production of animal food products. In India increase in milk production has been achieved through cooperative movement. Homestead production is another method for increasing production and consumption of vegetables, milk and animal products and reducing the gap in consumption especially among poorer segments of population. Farm wastes as well as food grains unfit for human consumption can be used to feed backyard poultry in order to increase homestead production of eggs and chicken and also increase consumption of these at home among poorer segments of the rural population.

Eleventh Plan goals for agricultural sector

The current challenges faced by the agriculture sector are to:

- continue to improve food grain production to meet the needs of the growing population;
- increase production of coarse grains to meet the energy requirements of the BPL families at a lower cost;
- increase production of pulses and make them affordable to increase consumption;
- improve the availability of vegetables at an affordable cost throughout the year in urban and rural areas.

The Approach Paper for the Eleventh Plan has taken into account all the challenges and will focus on strategies to overcome these and ensure that agriculture plays its critical role in economic growth as well as nutrition security for the population.

The Approach Paper to the Eleventh Five Year Plan has emhasised on rapid increase in agriculture growth to 4 %. Accelerated agricultural growth will require diversification into horticulture and floriculture which in turn imply structural changes in the relation between agriculture and non-agriculture. Diversification requires effective marketing linkages, supported by modern marketing practices including introduction of grading, post-harvest management, and cold chains.

The National Agriculture Policy (NAP), 2000 and the Eleventh Plan have set a target of a 3.9 % growth for agriculture. This is to be achieved through:

- growth that is based on efficient use of resources and conservation of soil, water and bio-diversity;
- growth with equity, i.e., growth which is widespread across regions and covers all farmers;
- growth that is demand driven and caters to domestic markets as well as maximizes benefits from exports of agricultural products in the face of the challenges arising from economic liberalisation and globalisation;
- growth that is sustainable technologically, environmentally and economically.

The sector has the opportunity to contribute towards substantial increase in GDP, provide employment in rural areas, improve nutrition security of the population and achieve significant decline in macro and micronutrient under-nutrition.

Reference

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