CHAPTER VI

AGRICULTURE AND ALLIED INDUSTRIES

I. Agriculture in the National Economy

India is primarily an agricultural country and the agricultural sector is the mainstay of the national economy accounting for almost half of its national income and three-quarters of its working force. Agricultural commodities comprise almost 80 per cent of the total consumer expenditure. Fluctuations, in agricultural output levels, therefore, play a key role in the state of the national economy. Prices of consumer goods as also the general price level fluctuate with the rise and fall in agricultural prices. Price variations influence, in turn, the wage levels. The purchasing power of the vast majority of the people in India is thus inextricably linked up with the fluctuating fortunes of agriculture.

In the sphere of international trade also agriculture has the place of pride. The main agricultural commodities which are exported are tea, oilcakes, fruits and vegetables, spices, tobacco (raw and manufactured), cotton (raw and waste), coffee, cocoa, sugar and sugar products, hides and skins, raw wool and other varieties of animal hair and vegetable oils. Cotton and jute textiles, which are important commodities, also depend for their raw material on agriculture. The share of agricultural commodities in the import trade has varied from 38.6 per cent in 1960-61 to 51.1 per cent in 1967-68 ; import commodities being cereals and cereal preparations, raw cotton, fruits and vegetables, fertilizers (crude and manufactured), vegetable oils and fats, dairy products, raw jute, tractors, raw wool, rubber and agricultural machinery and implements. Efforts are being made to reach self-sufficiency in agricultural commodities, specially foodgrains, raw cotton and jute.

Economic regeneration is being attempted over a succession of Five Year Plans. The tempo of industrialization is being built up and agricultural output has to grow so as to meet the raw material requirements of various agro-based industries as also to provide not only better nutritional standards, but also to meet the demand for various food items at improved levels of income. It has been the experience the world over that in predominantly agricultural

economies, agriculture has to serve as the base for capital formation in the earlier stages of economic development.

After two successive years of drought marked by uncertainty of food imports and a rather steep upward swing in prices, the last two years, 1969-70 and 1970-71, have produced an all time record production of foodgrains. Self-sufficiency in food for which the country had been striving hard over the successive Five Year Plans seems to be in sight for the first time and the Government has announced its policy of stopping all imports after 1971.

Occupational Pattern : Agricultural classes consisting of cultivators (78.7 million) and agricultural labourers (47.3 million) formed about 70 per cent of the total workers of 126 million in 1971. Dependence on agriculture was more marked in the rural sector constituting about 80 per cent of the total population. A look at the census data will reveal that urban population as a proportion of the total has remained more or less constant during the last several years. This constituted 17.3 and 18.2 per cent of the total population according to 1951 and 1961 Census respectively. The agricultural sector thus continues to absorb a major proportion of the increase in the total working force.

National Income : Distribution of national income by industrial origin for the period 1950-51 to 1969-70 (the latest year for which such estimates are available) shows that the share of various agricultural commodities, animal husbandry, and ancillary activities has ranged from 45 to over 50 per cent at current prices during this period. The contribution of forestry and fisheries to the national output was not very significant, having ranged between 0.7 to 0.8 per cent in the case of forestry and 0.4 to 0.7 per cent in the case of fisheries (Table I).

Sectoral importance of various products which constitute this broad sector can be examined from the available data. The gross value of output from agriculture, animal husbandry, and ancillary activities was Rs. 156.1 billion during 1969-70 at current prices. Of this, the share of animal husbandry comes to over 20 per cent. Within agriculture, foodgrains (including cereals, pulses, and gram) generally account for nearly 50 per cent of the total. Taking into account all the major cash crops, i.e. oilseeds, sugarcane, fibres, tea, tobacco, chillies, and fodder, the gross value of non-food crops including straw accounts for nearly 25 per cent of the gross cropped area.

Statistics of output as well as value of these non-food crops are rather scanty. The position is no better in respect of animal husbandry, fisheries, and forestry. With improvement in the statistics in respect of these products, it is quite likely that the real contribution

TABLE I

National Income According to Major Heads at Current and Constant 1960-61 Prices

(Billion Rupees)

Industry	1950-51	1955-56		1960	1965-66		1966-67		1968-69		1969-70	
	Current Prices	*Current Prices*	1960-61 *Prices*	*Current Prices*	*Current Prices*	1960-61 *Prices*	*Current Prices*	1960-61 *Prices*	*Current Prices*	1960-61 *Prices*	*Current Prices*	1960-61 *Prices*
1	2	3	4	5	6	7	8	9	10	11	12	13
Agriculture, animal husbandary and ancillary activities%	48.9 (51.3)	45.2 (45 3)	59 0 (54.1)	68.2 (51.3)	99 5 (48.2)	64 4 (43.0)	120 1 (50.2)	64.4 (42 3)	145.0 (50.6)	75.4 (44.2)	156.1 (50.1)	79.3 (44.1)
Mining, manufacturing, small enterprises, construction, electricity, gas and water supply	15.3 (16.1)	18.5 (16.6)	19.7 (18.1)	26 9 (20.2)	43.8 (21.3)	36,1 (24 0)	48.0 (20.1)	36.8 (24 1)	56:0 (19.5)	39 4 (23.1)	62.7 (20 1)	41.6 (23.2)
Commerce, transport and communication	16.9 (17.7)	18.8 (16.6)	18.8 (17.3)	24.1 (18.2)	41.0 (19.9)	31.4 (20.9)	47.0 (11.6)	32 28 (21.2)	56.0 (19.5)	34.8 (20 4)	60.3 (19.3)	36.7 (20.4
Other Sources+	14.4 (15 1)	17.3 (17.3)	11.6 (10.6)	14 4 (10 9)	23 6 (11 4)	19 6 (13.0)	26.3 (11.0)	20.4 (13.4)	32.3 (11.3)	22,6 (13.3)	35.2 (11.3)	23.8) (13.3)
Net factor income from abroad	(—) 2 (—) 0.2	— —	(—)0 10 (—)0.9	(—)0.7 (—)0.5	(—)1.65 (—)0 8	(—)1.5 (—)1.0	(—) 2.3 (—) 1.0	(—) 1.5 (—) 0.9	(—) 2.6 (—) 1.0	(—) 1.8 (—) 1.0	(—) 2.6 (—) 0:8	(—)1.8 (—)1.0
Net national product at factor cost	95.3 (100.0)	99.8 (100 0)	109.1 (100 0)	132 9 (100.0)	206.2 (100.0)	150.2 (100 0)	239 0 (100 0)	152.4 (100.0)	286 8 (100 0)	170.6 (100.0)	311.7 (100.0)	179.6 (100.0)
Per capita income (in rupees)	266.5	255.0	273.7	306.3	426.1	310.4	482.9	307.9	554 7	32.9	589 3	339.4

% Industry, forestry and fishing.

+ Comprising professional and liberal arts and government services.

of agriculture and its allied sectors might be discovered to be more than the one depicted by the incomplete data.

Foreign Trade : Commodity-wise contribution of the various agricultural commodities to the import and export trade of the country for the last five years are presented in Tables II and III. The quantum of gap in a particular year is very much influenced by the production level attained both in regard to imports and exports. Apart from the levels of agricultural production, there are many other internal and external factors which exercise an influence on the magnitude of these trade flows. External factors may be those relating to the price and production situation in the country from which our imports originate or those to which our exports are destined. The importing countries have also an influence on the magnitude of our export trade flows. Important internal factors which have a bearing on the pattern of export trade in agricultural commodities are: (i) export policy regulations and control measures; (ii) trade agreements with the various countries in regard to agricultural commodities ; (iii) development of trade institutions and organizations like UNCTAD and GATT; and (iv) the internal demand and the export surplus.

On the importing side, the exigencies of foreign exchange situation are of paramount importance and the import policy has necessarily to be of a restrictive nature. Import policy has to be shaped with an eye on ensuring an even flow of the availability of essential requirements of the economy in general and of the export and defence oriented industries in particular. In the agricultural sector, there is need for import of (a) foodgrains, to meet the gap between the total internal demand and supply till we have reached the level of self-sufficiency; (b) fertilizers and other inputs of industrial origin which cannot be indigenously produced; and (c) essential raw materials not indigenously produced for the running of certain agro-based industries more important of which are jute and cotton textiles. What is important in the overall context is the import bill for cereals and cereal preparations. They accounted for 15 to 17 per cent of the total imports in years of normal production. In bad years, however, when production fell due to vagaries of weather, this increased to over 25 per cent.

A study of the export possibilities in a long range perspective would indicate that the importance of these agricultural products is not likely to decline. As far as one can foresee, foreign exchange earnings of the country will continue to be derived to a large extent from these agricultural raw materials. On the import side, the possibility of eliminating imports of certain other agricultural raw

TABLE II

Imports of Major Agricultural Commodities

(Rs. crores)

Commodities	1960-61	1967-68	1968-69	1969-70	1970-71
1. Cereal & Cereal preparations	285.7 (15.9)	518.2 (25.8)	336.6 (17.3)	261.0 (16.7)	213.0 (13.1)
2. Cashew Nuts (unprocessed)	15.1 (0.8)	25.1 (1.3)	31.4 (1 6)	27.6 (1.8)	29.4 (1 8)
3. Copra	18.3 (1.0)	4.4 (0.2)	2.6 (0.1)	2.8 (0.2)	3.2 (0.2)
4. Crude Rubber (including synthetic & reclaimed)	17.0 (0.9)	4.4 (0.2)	4.9 (0.3)	9.6 (0.6)	3.8 (0.2)
5. Fibres of which :	159 6 (8.9)	105 3 (5.2)	121 8 (6.4)	111.1 (7.1)	126.7 (7.8)
(a) Raw wool	16.4 (0 9)	11.8 (0.6)	11.2 (0.6)	17.2 (1.1)	16.1 (1.0)
(b) Raw cotton	128 8 (7.2)	83.0 (4.1)	90.2 (4.7)	82 8 (5 3)	98.3 (6.0)
(c) Raw jute	12.0 (0.7)	1.8 (0.1)	9.3 (0.5)	1.1 (0.1)	0 2 (0.01)
6. Animal & Vegetable Oils & Fats	7,2 (0.4)	34.4 (1.7)	19.3 (1.0)	29.6 (1.9)	38.5 (2.4)
7. Fertilizers & Fertilizer materials	23 4 (1.3)	209.5 (10.4)	198.2 (10.4)	107.4 (6.9)	61.2 (.8)
8. Pulp and Waste Paper	10 6 (0 6)	10.3 (0.5)	10.4 (0.5)	12.5 (0.8)	12 3 (0.8)
9. Paper, Paper Board and manafactures thereof	19.1 (1.1)	17.7 (0.6)	18.3 (1.0)	23.7 (1.5)	25.0 (1.5)
Total Value of Imports	1,795.0 (100.0)	2,007.6 (100.0)	1,908.6 (100.0)	1,567.5 (100.0)	1,626.2 (100.0)

TABLE III

Exports of Major Agricultural Commodities

(Rs. crores)

	1960-61	1967-68	1968-69	1969-70	1970-71
1. Jute Manufactures	212.9	234.1	218.0	206.7	189.2
	(20.5)	(19.5)	(16.1)	(14.6)	(12.4)
2. Tea	194.7	180.2	156.5	124.5	148.2
	(18.7)	(15.0)	(11.5)	(8.8)	(9.7)
3. Cotton Fabrics	90.6	65.4	70.5	69.7	97.4
	(8.7)	(5.5)	(5.2)	(4.9)	(6.4)
4. Coir Yarn and Manufactures	13.7	12.8	13.8	13.4	13.6
	(1.3)	(1.1)	(1.0)	(0.9)	(0.9)
5. Oil Cakes	22.5	45.5	49.5	41.5	55.4
	(2.2)	(3.8)	(3.6)	(2.9)	(3.6)
6. Leather & Leather manufactures	39.3	53.5	72.7	81.5	72.2
	(3.8)	(4.5)	(5.4)	(5.8)	(4.7)
7. Cashew Kernels	29.8	43.0	60.9	57.4	52.1
	(2.9)	(3.6)	(4.5)	(4.1)	(3.4)
8. Tobacco	24.8	35.6	33.8	33.4	32.6
	(2.4)	(3.0)	(2.5)	((2.4)	(2.1)
9. Coffee	11.4	18.2	18.0	19.6	25.1
	(1.1)	(1.5)	(1.3)	(1.4)	(1.6)
10. Sugar	3.8	16.0	10.2	8.6	27.6
	(0.4)	(1.3)	(0.8)	(0.6)	(1.8)
11. Pepper	13.4	13.1	9.7	16.2	16.3
	(1.3)	(1.1)	(0.7)	(1.1)	(1.1)
12. Hides & Skins Raw & Fur Skins	14.9	7.6	5.3	8.4	3.8
	(1.4)	(0.6)	(0.4)	(0.6)	(0.2)
13. Raw Cotton	13.7	14.8	11.1	14.7	16.4
	(1.3)	(1.2)	(0.8)	(1.0)	(1.1)
14. Fish and Fish preparations	7.3	18.4	22.7	31.5	30.5
	(0.7)	(1.5)	(1.7)	(2.2)	(2.0)
15. Vegetable Oils (essential and non-essential)	19.9	7.7	16.1	9.3	9.7
	(1.9)	(0.6)	(1.9)	(0.7)	(0.6)
Total Value of Exports	1,039.8	1,198.7	1,357.8	1,413.3	1,524.4
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

materials like superior varieties of cotton, jute, etc., during the next few years cannot be visualized. A situation of nearly overall self-sufficiency in the matter of foodgrains is, however, contemplated in near future when all concessional imports may be stopped.

Consumption Expenditure: Reports of various rounds of National Sample Survey give useful data on consumption expenditure. Generally speaking, as much as 63 per cent of the total expenditure is incurred on food, with foodgrains accounting for nearly 37 per cent. Another 16 per cent of the consumer expenditure is incurred on items like textiles, foot-wear, fuel, and household equipment all of which are mostly of agricultural origin. This aggregates to 79 per cent of the total consumer expenditure. As the achievement of certain nutritional norms is an essential feature of plan formulations, percentage share of food items in the total expenditure is likely to remain at the present levels, at least for some time to come, although the importance of cereals will slowly go down and other foods rich in protein will be consumed more and more.

II. Environmental Factors

Agriculture depends on nature. Recent advances in science and technology have helped to reduce dependence on nature. But handicaps placed by nature can be overcome only at a cost. Thus, an appraisal of environmental factors is essential both for assessment of agricultural potential and for deciding on efficient land use patterns and management techniques in order to obtain maximum possible agricultural output.

Several environmental conditions affect crop production. Attention has been focussed here on two of them which are of crucial importance, *viz.*, soil and climate. An attempt is made to highlight those features of Indian soils and climate which have an important bearing on agriculture.

Soils: Systematic soil surveys and soil testing is a relatively recent development in India. District Gazetteers and Revenue Settlement Reports compiled during the British regime contain a good deal of useful information on soils. But most of it is based on personal observations and experience—albeit of very shrewd and perceptive revenue officers. The first attempt to classify Indian soils on the basis of parental rock materials was made by Leather in 1898. His four-fold grouping of Indian soils has formed the traditional classification. A good account of traditional classification of Indian soils is to be found in the Report of the Royal Commission on Agriculture in India, 1928. The traditional classification of Indian soils into four major types—alluvial, *Regur* (black cotton soil), red

and laterite—has been followed in all standard works on Indian geography.

Soil survey work during pre-1928 period suffered from absence of a co-ordinated all-India approach. General soil studies were made with regard to their contents of plant nutrients and mechanical analysis of their composition which yielded useful agronomic information. But these studies pertained to very small areas and were of isolated character. One of the grievous defects of such isolated studies was that no standard and uniform methods of sampling and analysis were followed. All such studies, though useful in themselves, were of little help in the work of detailed soil mapping for the country.

The Royal Commission on Agriculture, 1928, recognized the importance of systematic soil survey work. It recommended soil surveys for specific purposes and emphasized the need for "intensive studies of the more important types of soil" and for "collection and publication of all the information in regard to the composition and characteristics of Indian soils which is available."

Extensive soil surveys were initiated in the Punjab in 1928. Soil survey work was extended gradually to other areas in the subsequent period. The Indian (then Imperial) Council of Agricultural Research sponsored the scheme for collection, critical examination and collation of the information collected. The Report which was completed in 1946 contains all information on soils and crops available in the country upto 1945. This report was published in 1953.

Emphasis on planned agricultural development since independence has brought to light the imperative necessity of soil surveys and soil testing. An All-India Soil Survey Scheme was started in 1956, primarily for conducting reconnaissance soil surveys. This Scheme was later integrated with the Land Use Planning Scheme of the Central Soil Conservation Board and is now known as All-India Soil and Land Use Survey Scheme. Extensive field-work has been done to fill up the gaps in the existing knowledge regarding soils. Information collected upto the year 1960 was brought together in a comprehensive volume and published by the Indian Council of Agricultural Research towards the end of 1963. It contains soil maps for all-India and State-wise. It gives a comprehensive account of soil surveys and soil information for each of the States and Union Territories. Among several aspects covered for each State are : geology, climate, vegetation, irrigation, soil fertility, soil characteristics like physical, chemical and physico-chemical properties. State-wise details are given regarding formation, structure, genesis, profile,

p.H values, and classification of soils, and also methods of their reclamation and management.

Despite extensive soil survey and soil testing work in India since independence, soil mapping and correlation has not yet proceeded very much beyond delineation of the broad pattern of soil orders and sub-orders largely related to macro-regional and regional characteristics pertaining to climate and vegetation, slope and regolith (Table IV).

There are four major groups of soils in India :

(i) Alluvial
(ii) Black
(iii) Red
(iv) Laterite and Lateritic

Alluvial Soils : These soils constitute by far the largest group of soils in India, covering nearly 15 lakh km. They are derived from silt deposited by the numerous rivers throughout the length and breadth of the country, from deltaic alluvium, and from coastal alluvium. They are found mainly in the states of the Punjab, Rajasthan, Uttar Pradesh, Bihar, West Bengal and parts of Assam and Orissa. They also occur in the valleys of Brahmaputra and Surma in Assam, of Narbada and Tapti in Madhya Pradesh, and of Godavari, Krishna and Kaveri in South India. Geologically, alluvial soils may be divided into two broad sub-divisions, *viz.*, older and newer alluvium. The older alluvium, locally known as *Bhangar*, is in the process of denudation. The recent alluvium locally known as *Khadar*, is in the process of building up. Alluvial soils differ widely in texture and consistency, ranging from sands through loams fine silt and heavy clay. Older alluvium is of more clayey composition, generally dark coloured and full of lime nodules, called *Kankar*. Newer alluvium, on the other hand, is sandy, generally light coloured and of less *Kankar* composition.

Alluvial soils exhibit wide spread deficiencies of plant nutrients and suffer from general physical defects. Marked deficiency of nitrogen and humus is caused by the fact that high temperature leads to quick decomposition of organic matter. Most of the phosphorus found in these soils is present in inorganic forms, especially calcium phosphates. This difficulty is further accentuated in case of calcareous soils because their calcareous nature hastens the conversion of applied phosphates also into more insoluble forms of calcium phosphates. The total amount of potash in these soils is generally adequate but there are indications of frequently high fixation of it. Thus balanced use of NPK is considered desirable for obtaining high yields of crops on these soils. This is corroborated by information

Extent of area of the soil groups of India

TABLE IV

Sl. No.	*Soil groups*	*Area* *Sq. kilometres*	*Million acres*
1&2	Alluvial soil, riverine, old and recent; non-saline, non-calcareous to moderately calcareous	1,012,000	200.00
3.	Alluvial soil, riverine, highly calcareous	89,000	22.00
4.	Soil developed on coastal alluvium, occasionally saline	85,000	21.00
5.	Soil developed on deltaic alluvium, occasionally saline	180,000	44.48
6.	Alluvial soil, riverine, affected by salinity and alkalinity	68,000	16.80
7.	Pedocal sierozem of alluvial origin	40,500	10.00
8.	Pedocal brown and soil of alluvial origin	34,000	8.48
9.	Grey brown (Desert) soil	36,400	9.00
10.	Desert soil	106,000	26.19
11.	Deep black soil	68,800	17.01
12.	Medium black soil	214,500	53.00
13.	Shallow black soil	58,500	14.46
14.	Black soil affected by salinity and alkalinity	69,000	17.05
15.	Black soil undifferentiated	135,000	33.36
16.	Mixed black and red soil	115,000	28.42
17.	Ferruginous red soil	90,800	22.44
18,	Ferruginous red and gravelly soil	60,500	14.05
19.	Red and yellow soil	198,000	48.93
20.	Laterite	128,000	31.63
21.	Laterite and lateritic soil	120,200	29.71
22.	Brown soil (under deciduous forest)	26,200	6.48
23.	Forest soil	164,700	40.71
24.	Podsolic soil	36,400	9.00
25.	Foot-hill/*Terai* soil	46,600	14.00
26.	Mountain and hill soil	13,300*	3.29*
27.	Mountain meadow soil	11,700	2.89
28.	Peat	150	0.04
29.	Eternal snow	48,984	12.10

*Including Sikkim and Bhutan.

relating to responsiveness of yield to applications of fertilizers available from experiments conducted on farmers' fields.

Deficiencies of micro-nutrients have also been observed. The sandy soils of this group are reported to be deficient in sulphur. Deficiencies of zinc, iron and manganese are not uncommon. Besides, it is felt that boron may be present in toxic amounts, particularly, in saline-alkali soils of this group. Deficiencies of micro-nutrients may become more marked with the increases in yields resulting from the extended use of high-yielding varieties and greater application of water and NPK.

Some of the soils in this group show certain defects with regard to their physical properties. There is occurrence of hard pan, clay pan and caliche pan which impede penetration of plant roots and percolation of water. High bulk density has adverse effect on yields in some of the areas like the serozem belt of the alluvial soils of the Punjab, Rajasthan and Gujarat, which grow much of American cotton. Fairly extensive areas are affected by problems of water logging and salinity and alkalinity.

Black Soils : This is the second largest group of soils, covering an area of about 5.5 lakh km. These soils have developed over the lava deposits of Deccan trap and are locally known as *Regur*. The black soils are derived from two types of rocks, the Deccan and the Rajmahal trap ferruginous gneiss and schists occurring in the state of Tamil Nadu under semi-arid conditions. This group of soils is found in central and western Madhya Pradesh, southern Orissa, southern and coastal Andhra Pradesh, northern Karnataka and almost the whole of Maharashtra. They also occur in parts of Gujarat, Rajasthan, Uttar Pradesh and Tamil Nadu.

The black soils have predominantly clayey character. They are highly sticky in character, with better moisture retaining capacity. They are difficult to plough when wet because of stickiness. The presence of montmorillonite type of clay minerals imparts the property of high expansion and shrinkage to these soils. They crack during hot dry weather and are thus "self-ploughing". These soils are generally rich in potash, iron, lime, etc., but deficient in nitrogen, phosphoric acid and organic matter. Defficiency of zinc is also observed. A major problem with these soils is their bad structure. They have to be worked at the proper moisture level. Otherwise, their structure is spoilt. Some of these soils also suffer from salinity and alkalinity and present drainage difficulties. These soils are locally known as *Chopan*.

Red Soils : These soils cover an area of about 3.5 lakh km. They have developed from the weathering of the ancient crystalline metamorphic rocks. They consist largely of granites,

gneisses and schists with subordinate rocks rich in ferro-magnesium minerals. These soils occur in large parts of Tamil Nadu, Karnataka, north-east Andhra Pradesh, south-east Maharashtra, Madhya Pradesh, Orissa and Chota Nagpur. They are also found in the Santhal Parganas of Bihar, certain districts of West Bengal, Uttar Pradesh and Rajasthan, and Khasi, Jaintia, Garo and Naga Hills of Assam.

Texturally, red soils are sandy to loamy and even gravelly on the upper slopes of the river valleys. They are generally porous with lesser moisture retaining capacity. There is absence of lime *Kankar* and free carbonates. Soluble salts are present in a small quantity. The reaction is neutral to acidic. These soils differ greatly in depth and fertility. There is general deficiency of nitrogen humus, phosphoric acid and lime. The predominance of kaolinitic clay minerals leads to high phosphate fixation.

Laterite and Lateritic Soils : These soils are peculiar to India and other countries with tropical climate characterized by high temperature and high rainfall with alternating wet and dry periods. Some recent writers would confine the term laterite to an already hardened, perhaps fossil, layer but laterite crust is not necessarily the end product of soil evolution as implied in many studies. To avoid confusion caused by different meanings attached to this term, Bunting suggested "perhaps it would be best to abandon the term laterite for a native term such as *Murram* or *Khoai* (West Bengal) and *Bowal* (Guinea)". In India also the use of the term laterite does not conform to standard terminology; and the term lateritic has been used as a hedge to include soils about which precise knowledge was lacking.

Laterite and lateritic soils cover an area of about 2.5 lakh km. Lateritic soils are specially well developed on the hill tops of the Deccan, Karnataka, Kerala, Madhya Pradesh, the Eastern Ghats of Orissa, Maharashtra, Malabar and parts of Assam. In Tamil Nadu, there are both high level and low level lateritics which are formed from a variety of rocks.

Laterite soils are characterized by the presence of a compact to vesicular mass in the sub-soil horizons, composed essentially of a mixture of hydrated oxides of iron and aluminium. There is separation of iron oxide in the form of nodules, and the gradual cementation of the latter to form an indurated honeycombed mass.

The texture of the soils in this group ranges from heavy loams to clay. These soils are usually deficient in nitrogen, phosphoric acid, potash, lime and magnesium. Although they are low in fertility, there is good response to manuring and soil management. Valley soils can yield good crops of rice and sugarcane.

5. Other Soils : Four more soil groups can be distinguished among the remaining soils in the country. Largest among them are forest soils covering an area of about 2.9 lakh km. These soils are characterized by the deposition of the organic matter derived from forest growth. These soils are found in Himachal Pradesh, sub-Himalayan tract of Uttar Pradesh, hilly districts of Assam, Darjeeling district, Coorg and Malabar district. Second important soil group consists of desert soils covering an area of about 1.4 lakh km. distributed over arid and semi-arid region of the Punjab and Rajasthan. These tracts are covered by a mantle of blown sand which impedes soils development. The third group of saline and alkali soils is the result of concentration of salts owing cheifly to lack of underground drainage. Capillarity action during summer brings them to the surface where they form a white efflorescent crust. These soils are known under various local names, *viz.*, *Reh*, *Kallar* and *Usar*. Large areas of land in the Punjab, Uttar Pradesh, Maharashtra and Gujarat have been rendered infertile by saline and alkaline effervescences. The fourth group of soils comprises peaty and other organic soils. Typical peaty saline soil is found in Kuttanad in Kerala, where it is known under the local name of *Kari* and cover an area of about 150 km.

Climatic Conditions : India is characterized by essentially a tropical climate. Although the northern part of India falls into the subtropical zone, it is protected from cold winter winds by the great mountain wall of the Himalaya. Monsoons impart a distinctive character to India's climate. The effects of temperature and rainfall conditions on agriculture are discussed below:

Temperature : High temparature has adverse effects on the humus content of soils. High temperatures also increase water losses of soils. Besides, warm and humid weather stimulates the growth of weeds which compete with crop nutrients and pests that thrive on plant life. Otherwise temperature is not considered to be a serious limitation on growth of plants in India. Sunlight is adequate for the efficient growth of crops. Sunny days are generally sufficient and quite evenly spread over the year in different parts of the country. The length of the growing season presents no problem in most parts of the country. This is a very great natural advantage as compared to the countries with temperate climate.

Rainfall : India's major handicap is rainfall. High temperature increases loss of water through evaporation and transpiration. Actual rainfall is thus rendered inadequate over vast regions. Besides, rainfall is unevenly spread over the year. The erratic nature of monsoons leads to the spectres of famines and floods. In the absence of data on losses of moisture through evaporation and

transpiration, it is not possible to map out precisely areas of deficient rainfall. But a rough estimate is as follow :

	Net area sown (Thousand hectares)
1. High Rainfall regions (1150 mm. and above)	41,689
2. Medium Rainfall regions (750-1150 mm.)	49,308
3. Low Rainfall regions (upto 750 mm.)	47,123
Total	138,120

The above figures emphasize the need for evolving suitable dry farming techniques to step up agricultural output in vast areas characterized by deficient rainfall. Research work in this direction was initiated in the erstwhile Bombay province in 1926. The need for such efforts has been greatly intensified by the recent introduction of high yielding varieties which require more water than ordinary varieties of crops. Regional imbalance will be aggravated if areas of deficient rainfall lag behind in agricultural development. Thus, the imperative need for increasing agricultural output as well as the desirability of balanced regional development underline the urgent necessity of evolving suitable varieties and adopting appropriate agricultural practices in regions of inadequate rainfall.

III. Land Utilization

Before independence, the total geographical area of India was classified into the following five broad heads for purposes of land utilization statistics:

1. Area under forests
2. Area not available for cultivation
3. Uncultivated land excluding current fallows
4. Area under current fallows
5. Net area sown

In 1947, when the country became free, the erstwhile princely regions were merged with the former provinces and intermediate tenures like zamindari, etc., were abolished. Detailed land surveys had not been carried out in these areas in the past. The then available data were defective, because it gave no idea of the potential capacity of land for various uses, or even for potential supply of land for extension of cultivation. To get a better picture of the potentialities for land development for cultivation, as well as non-agricultural purposes, a land survey was undertaken in 1949-50.

Standard definitions of the various classes of land were evolved to be followed by all States. Prior to this, the available data were not comparable, because definitions of land classes among different States were not uniform.

There used to be a considerable time lag in the publication of the land utilization data, which has now been reduced from five to three years. There was no clear and meaningful distinction between culturable waste and fallow land; and between cultivable land and culturable waste. The classification suggested for immediate adoption with a view to facilitating accurate assessment of potential area available for cultivation, for grazing, for forest and tree growing etc., is as under:

1. Forests
2. Land not available for cultivation;
   - (i) land put to non-agricultural uses;
   - (ii) barren and unculturable land;
   - (iii) permanent pastures and other grazing lands;
   - (iv) miscellaneous tree crops and groves not included in the net area sown;
   - (v) cultivable waste;
   - (vi) fallow land other than current fallows;
   - (vii) current fallows.
3. Net area sown.

Data are also available regarding the area on which more than one crop is harvested in a year. This land is classed as "double cropped area" or "area sown more than once". Gross cropped area consists of net area sown plus area cropped more than once.

Detailed statistics of land use which mainly give the area of land put to different agricultural uses are available almost continuously from 1887-88. The present coverage of land use and crop statistics is about 94 per cent of the total geographical area of the country—77 per cent covered by complete enumeration, 5 per cent by sample surveys and another 12 per cent by conventional estimates. Since the remaining non-reporting area of 6 per cent is mainly covered by hills and forests and there is very little cultivation on it, the present position of land use in the country could be considered quite satisfactory although there is still scope for improvement.

The reporting area which stands for the area for which data on land use classification are available, has considerably increased from 284.3 million hectares in 1950-51 to 305.8 million hectares in 1968-69, i.e. from 87 to 94 per cent (Table V). Where land utilization figures are based on land records, reporting area is the one according to papers prepared by the village accountant. In some cases, the village papers may not be maintained in respect of the entire area of

the State. For example, such papers may not be prepared for the forest area, but the marginal role of such area is known. Also, there are tracts in many states for which no village papers exist but for which *ad hoc* estimates of classification of area are framed to complete the coverage. In such cases, this gives the summation of the area for which village papers actually exist and the area for which *ad hoc* estimates are available.

Forests : Area under forests includes all actually forested areas or lands classed or administered as forests under any legal enactment dealing with forests whether State owned or private. If any portion of such land is not actually wooded but put to some agricultural use, that portion is included under the appropriate head of cultivated or uncultivated land. Forest statistics are collected by the Forest Department in a State and published in the Indian Forest Statistics. Agriculture or Revenue Departments also collect forest statistics, but the two sets of figures do not tally. Some of the reasons for the same are:

(a) Certain lands not covered by forests but worked by Forest Department, are counted as forests by the Forest Department and included in the area under forests. The same are not treated as forests by the Revenue/Agriculture Department, and are put under any of the other heads such as "other uncultivated land excluding fallow lands", if they are covered with shrubs, bamboos or other grasses and under "net area sown" if they are cultivated.

(b) Forest areas deemed to be "unprofitable" and some of the areas administered as forests by corporate bodies or private individuals are sometimes classified by some States as "area not available for cultivation" or "other uncultivated land excluding fallow lands."

(c) Difference in coverage both in respect of period and area.

(d) Difference in the method followed by the two Departments in the enumeration of the forest areas.

Land not available for Cultivation : This consists of two parts. (1) Land put to non-agricultural uses—These are lands occupied by buildings, industrial undertakings, roads and railways or those under water *e.g.* rivers and canals, and all other lands put to non-agricultural uses. As in India, urbanization and industrialization lead to an increase in the area under this category. (2) Barren and uncultivated land—This covers all barren and uncultivated lands like mountains, deserts, etc. In Rajasthan, such lands lie mostly in the Thar desert, where the soil is sandy and rainfall is below 50 cm. In other States, they are generally in areas where the topography is hilly and/or is covered with laterites or such soils as are highly infertile, stony and coarse and the rainfall is insufficient so that

it is hardly possible to develop or cultivate these lands on a reasonable cost.

Other Uncultivated Lands excluding Fallow Lands

(a) Culturable Waste : These include lands available for cultivation whether or not taken up for cultivation or abandoned after a few years for one reason or another. Such land may either be fallow or covered with shurbs or jungles which are not put to any use. Land once cultivated, but not cultivated for five years in succession is included in this category. It is a sort of residual class which includes all uncultivated lands not accounted for by any other class. Over 6 million hectares of land have been taken out of this category. It is a potential area for cultivation, though it would be a misnomer to describe that all the land under this category is 'culturable'. A Waste Land Survey Committee went into this matter in 1959 and studied the position for 7 important States in the country. Land available for cultivation in holdings over 100 hectares was estimated by the Committee at 4,50,000 hectares. Another survey for locating culturable waste lands in smaller blocks was taken up during the Third Plan. An additional area of 2.2 million hectares has been located which will be available for cultivation in the coming five years.

(b) Permanent Pastures and other Grazing Lands : These include all grazing lands, whether they are permanent pastures or meadows. The common land—*shamlat*—in the villages and grazing land in the forest area, are included under this head. These lands have tended to increase during the last one and a half decades, partly because in certain states there is a legal provision to maintain a minimum area for grazing cattle. The increase has been particularly noticeable in Maharashtra and Gujarat.

(c) Land under Miscellaneous Tree Crops, etc : All the culturable land put to some agricultural use, but not included under net area sown is included under this head. Lands under thatching grass, bamboo bushes and other grove trees for fuel etc., which are not included under (a) or (b), are placed in this category. Land under this category has decreased from 19.8 million hectares in 1950-51 to only 4.1 million hectares in 1968-69.

Fallow Lands : This category can be divided into two sub-groups : (a) fallow lands other than current fallows, and (b) current fallows.

(a) Fallow Lands other than Current Fallows : This includes lands which were taken up for cultivation, but are temporarily out of cultivation for a period of not less than one year and not more than

five years. The causes for such lands going out of cultivation may be :

1. Inability of farmers to cultivate for lack of means.
2. Inadequate irrigation facilities.
3. Unsuitable climate.
4. Unremunerative nature of farming.

About 7 per cent of the total geographical area of the country is still constituted as fallow land, though it was considerably reduced from 28.1 million hectares in I950-51 to 20.8 million hectares in 1967-68. There was an increase of 2.2 million hectares during 1968-69 which was primarily due to bad weather conditions. Poor fertility is the major cause for land becoming fallow and much of it, in course of time, may be added to the category of 'cultivable waste'.

(b) Current Fallows : This class comprises cropped areas which are kept fallow during the current year. For example, if any planted area in the last season is not cropped again in the year reported, it is treated as current fallow. There is, however, a close link between the fallow land and the net area sown, since there are frequent shift-overs from one to the other. Good and timely rainfall, weather conditions, prices, political stability, security of tenure and tenancy conditions help in increasing the area sown.

Net Area Sown : It is the actual physical area under crops and orchards. Areas cropped more than once are counted only once in this category. This area has steadily increased from 118.7 million hectares in 1950-51 to 139.7 million hectares in 1967-68 (Table V). This addition has been possible because of land reclamation operations, reduction in fallow lands and appreciable decline in culturable waste, as a result of virgin lands coming under cultivation on account of new irrigation projects, adoption of soil conservation measures, etc. It is quite possible that net sown area may continue to increase as a result of the operation of these factors. Assuming that annual net sown area is of the order of a million hectares, it can be estimated that there is in the country today an area of about 143 million hectares as net sown which will constitute about 43 per cent of the total geographical area in the country.

India today is perhaps one of those countries where arable land under permanent crops constitute the maximum proportion of the total area in the country. During the year 1967, area under this classification in India was as much as 50 per cent against a figure of 32.2 per cent for Yugoslavia, 30.3 per cent for the United Kingdom, 29.8 per cent for Pakistan, and as low a figure as 4.3 per cent for Canada and 5.4 per cent for Australia (Table VI).

TABLE V

Land Utilization Statistics—All-India (1950-51 to 1968-69)

(Million Hectares)

Particulars	*1950-51*	*1955-56*	*1960-61*	*1965-66*	*1966-67*	*1967-68*	*1968-69*
I. Geographical Area							
Geographical Area	326.8	326.8	326.8	326.8	326.8	326.8	328.0
II. Classification of Area							
Reporting Area for Land Utilization Statistics	284.3	291.9	298.4	305.3	305.4	305.6	305.8
(i) Forest	40.5	51.3	54.1	60.3	62.2	62.4	62.8
(ii) Not available for cultivation	47.5	58.4	50.7	50.3	48.3	48.1	48.1
(iii) Other uncultivated land excluding fallow lands—							
(a) Cultivable waste	22.9	21.5	19.2	17.2	17.0	16.6	16.5
(b) Permanent pastures and other grazing lands	6.7	11.5	14.0	14.9	14.1	13.9	13.8
(c) Land under miscellaneous tree crops and grooves (not included in net area sown)	19.8	5.9	4.4	4.1	4.1	4.1	4.0
Total	49.4	38 9	37.6	36.2	35.2	34.6	34.3
(iv) Fallow Lands—	28.1	24.1	22.8	22.4	22.6	20.83	23.08
(a) Fallow lands other than current fallows				9.23	8.98	8.78	9.01
(b) Current fallows				13.21	13.62	12.05	14.07
(v) Net Area Sown	118.7	129.2	133.2	136.2	137.2	139.7	137.6
III. Sown Area							
(a) Gross sown area	131.9	147.3	152.8	155.3	156.8	163.1	159.2
(b) Net sown area	118 7	129 2	133.2	136.2	137.2	139.7	137.6
(c) Area sown more than once (a)-(b)	13.2	18.1	19.6	19.1	19 6	23.3	21.6

TABLE VI

Land Utilization – Selected Countries of the World

(Million Hectares)

Country	Year	Total area	Land area	Agricultural Area		Forested land	Other Area		
				Arable land and land under permanent crops	Permanent meadows and pastures		Unused but potentially productive	Built-on area waste land and other	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
United Kingdom	1968	24,403 (100)	24,093 (98.7)	7,382 (30.3)	12 032 (49.3)	1,859 (7.6)	—	3,130 (12.8)	
Yugoslavia	1968	25,580 (100)	—	8,246 (32.2)	6,420 (25.1)	8,812 (34.4)	—	2,102 (8.2)	
U.S.S.R.	1968	2,240,220 (100)	—	224,000 (100.0)	373,700 (16.7)	910,009 (40.6)	—	732,211 (32.7)	
Canada	1966	997,614 (100)	922,081 (92.4)	43,404 (4.3)	20,957 (2.1)	443,094 (44.4)	—	490,159 (49.1)	
Mexico	1960	197,255 (100)	197,234 (100.0)	23,817 (12.1)	79,092 (40.1)	43,679 (22.1)	11,193 (5.7)	—	39,474 (20.0)
Netherlands Antilles	1951	96 (100)	96 (100.0)	5 (5.2)	— —	— —	— —	—	91 (94.8)

Argentina	1968	277,666 (100)	—	33,007 (11.9)	144,947 (52.2)	62,700 (22.6)	—	37,012 (13.3)	
Chile	1965	75,694 (100)	—	4,511 (6.0)	10,083 (13.3)	20,686 (27.3)	2,271 (3.0)	—	
Afghanistan	1967	64,750 (100)	—	7,844 (12.1)	6,000 (9.3)	2,000 (3.1)	—	48,906 (75.5)	
Burma	1966	67,803 (100)	—	16,087 (23.7)	354 (0.3)	45,274 (66.8)	—	6,088 (9.0)	
Ceylon	1968	6,561 (100)	6,474 (98.7)	1,980 (30.2)	439 (6.7)	2,899 (44.2)	119 (1.8)	—	1,124 (1.7)
China (Taiwan)	1968	3,596 (100)	3,536 (98,3)	900 (25.0)	2 (neg.)	2,224 (61.8)	—	470 (13.1)	
Hong Kong	1968	103 (100)	103 (100)	13 (12.6)	—	11 (10.7)	45 (43.7)	—	34 (33.0)
Indonesia	1963	190,434 (100)	—	12,697 (6.7)	56 (neg.)	152,177 (79.9)	—	—	
Iraq	1964	43,492 (100)	—	7,496 (17.2)	4,264 (9.8)	1,951 (4.5)	—	— 29,781 (68,4)	
Israel	1968	2,070 (100)	2,026 (97.9)	411 (19.9)	818 (39.5)	104 (5.0)	—	4.737 (35.6)	
Japan	1968	36,976 (100)	—	5,684 (15.3)	948 (2.6)	25,558 (69.1)	—	4,786 (12.9)	
Pakistan	1965	94,672 (100)	—	28,214 (29.8)	—	4,185 (4.4)	—	— —	
Australia	1967	768,681 (100)	—	41,461 (5.4)	448,108 (58.2)	35,473 (4.6)	—	243,639 (31.7)	
India	1967	326,810 (100)	—	163,720 (50 0)	14,070 (4.3)	60,500 (18.5)	17,050 (5.2)	—	71,470 (21.9)

Source : F.A.O. Production Year-book, 1969.

Area Sown more than once : This represents that portion of the net sown area on which two or more crops are grown during the period of one agriculture year. With the introduction of high yielding varieties and the programme of multiple cropping, there is likely to be an appreciable increase in the area under this category. During the period 1950-51 to 1967-68 there was an increase of nearly 10 million hectares. During 1950-51 it was only 13.2 million hectares. The present trend is not to give any vacation to the land. Raising three or even four crops in a year is a sound farming practice. Intensive use of land is nothing new to the farming world. Farmers of Taiwan make every 40 hectares work for about 72 hectares in a year, those of South Korea about 61 hectares and Japan about 48.5 hectares.

The Indian Agricultural Research Institute, New Delhi, has taken four crops—*moong*, maize, potato and wheat—under scientific management. In 1969-70, a total hectare yield of 15.2 tonnes was obtained in 355 days. This works out to 42.8 kg. per day per hectare. These yields are roughly five times more than those obtained in 1940 in fallow-wheat sequence and three times more than from maize-wheat rotation in 1950.

Plant breeders have evolved short duration and photo-insensitive dwarf varieties. Rice, wheat, maize, *bajra*, pulses, potatoes and several other crops have been improved this way. They can now be raised in non-traditional seasons. For instance, the relay cropping of *Moong Baisakhi* sown in summer instead of in monsoon yields 10 quintals a hectare though the traditional monsoon sown *moong* yields only 2.5 quintals. In the following *rabi*. a hybrid or a composite maize can be grown instead of in *kharif*. This maize will yield about 73 quintals of grain. This can be followed by *Sharbati Sonora* wheat giving about 86.5 quintals. One advantage of relay cropping is that it cuts tillage operations down.

IV. Irrigation

Plants require moisture during germination, growth and formation of fruits. Most annual plants cease to need moisture towards the end of their life cycle, when they wither and dry away. Perennial tree crops need moisture throughout their life. Crops can be grown without soil, but not without water.

Human efforts to fight nature's niggardliness in the supply of water to agriculture takes the form of irrigation in the first attempt. A major function of irrigation is to mitigate the impact of irregular, uneven and inadequate rainfall with wide fluctuations from year to year. It averts serious famine and semi-famine conditions. It also supplements supply of rain water, particularly in a country like

India where rainfall is concentrated in most regions in the monsoon months of June to September (Table VII). This additional supply of water makes possible harvesting of two or three crops or cultivation of crops requiring perennial water supply. Irrigation has assumed increasing significance under Indian agriculture in the context of the new technology where high yielding varieties and multiple cropping patterns are being adopted.

In most parts of India, moisture is a great limiting factor in the successful raising of crops. For successful farming, irrigation is, therefore, necessary in one form or the other in all parts of the country where the mean annual rainfall is less than 75 cm. It is indispensable for the economical use of land. When irrigation is provided, both land and labour can be put to profitable use throughout the year; crop yields can also be doubled and money return increased by growing valuable cash crops.

Irrigation has been practised by man for several millennia. Perhaps the earliest irrigation started in Egypt on the river Nile, and there are indications of irrigation as early as 5000 B.C. There is evidence of a masonry dam having been constructed across the Nile in about the year 4000 B.C. From the numerous references available, the use of artificial irrigation in India can be traced to as early a period as the fourth millenium B.C. In the Vedas, the earliest sacred books of the Aryans, mention is made of wells, canals and dams.

During the excavation by the Archaeological Survey of India at Besnagar near Bhilsa in Gwalior, remains of an old irrigation canal which is supposed to have existed there during the third century B.C. or probably earlier were exhumed. Similarly, there is a notable example of the construction of the Grand Anicut across the Cauvery about the second century A.D. which was remodelled by the British during the 19th century.

Some of the existing canal systems are also believed to be centuries old. Archaeological excavations in cities of Harappa and Mohanjodaro have revealed indications of existence of canals dating as far back as 1,500 B. C. Probably, these canals supplied water to serve both the purposes, to supplement supply of monsoon water and also to fight arid and semi-arid conditions. Importance of irrigation as a source of artificial water supply was thus understood long ago. During the second half of 19th century, frequent and severe famines compelled the Government to consider seriously major extension of irrigation water supply. In pursuance of this objective an Irrigation Commission was appointed in 1901. Its Report became available in 1905. The Commission, for the first time, studied the irrigation potential for extensive areas of several river basins, indicated their

TABLE VII

Region-wise Actual Rainfall—1970-71

(Centimetres)

Rainfall Region	*June 1st to September 30 1970*	*June 1970 to May 1971*	*2 as % of 3*
(1)	(2)	(3)	(4)
Bay Islands	1,511	3,060	49.4
North Assam (including NEFA)	1,569	2,102	74.6
South Assam (including Nagaland, Manipur and Tripura)	1,495	2,425	61.6
Sub-Himalayan, West Bengal	2,230	2,730	81.7
Gangetic West Bengal	1,267	1,890	67.0
Orissa	1,129	1,477	76.4
Bihar Plateau	1,044	1,379	75.7
Bihar Plains	944	1,171	80.6
Uttar Pradesh, East	1,075	1,309	82.1
Haryana (including Chandigarh & Delhi)	627	782	80.2
Punjab	525	676	85.1
Himachal Pradesh	1,176	1,482	79.4
Jammu and Kashmir	423	563	75.1
Rajasthan, West	310	358	86.6
Rajasthan, East	739	803	92.0
Madhya Pradesh, West	1,089	1,136	95.9
Madhya Pradesh, East	1,335	1,506	88.6
Gujarat region (including Daman, Dadra & Nagar Haveli)	1,173	1,188	98.7
Saurashtra & Kutch (including Diu)	829	844	98.2
Konkan (including Goa)	2,681	2,764	97.0
Madhya Maharashtra	541	677	79.9
Marathwada	895	1,001	89.4
Vidarbha	1,167	1,271	91.8
Coastal Andhra Pradesh	617	1,022	60.4
Telangana	981	1,150	85.3
Rayalaseema	525	775	67.7
Tamil Nadu (including Pondicherry)	285	938	30.4
Coastal Mysore	3,963	4,466	88.7
Interior Mysore, North	696	892	78.0
Interior Mysore, South	300	728	45.3
Kerala	1,609	2,734	58.9
Arabian Sea Islands	1,214	1,840	66.0

relative importance and laid down the principles governing investment in irrigation. During the following three decades major irrigation works were constructed. The Government, however, adopted a classification of irrigation works which led it to give preference to irrigation in regions where it would play a dominant role in extending cultivation. This policy resulted in restricting extension of irrigation and in concentrating the benefits to selected areas.

The Government classified irrigation works as : (i) productive, and (ii) protective. All works which did not yield revenue enough to meet interest charges after deducting cost were classed protective and only limited resources were committed to them. Studies of irrigation during the last two decades emphasized the indirect social benefits in the form of increased incomes, employment and foreign exchange earnings, with the result that the old classification was dropped and only the administrative classification of (i) major and medium, and (ii) minor irrigation works, was adopted. Upto the year 1964, the Plan schemes costing upto Rs. 10 lakhs were called minor schemes : the ceiling has since been raised to Rs. 15 lakhs. Schemes costing upto Rs. 5 crores are desginated as medium and those over Rs. 5 crores as major ones.

Irrigation Potential : No scientific hydrographic study of India's water resources has so far been undertaken. Rough estimates have been made from time to time which provide only a broad and approximate basis of launching irrigation schemes. In 1903, the Irrigation Commission estimated that the river water resources of the country were of the order of 145 million hectare metres. In 1949, a study estimated that the surface flow of water in the country was about 169 million hectare metres. But owing to physiographical conditions of the country, only one-third of this surface flow or about 561 million hectare metres could alone be used for irrigation purposes and about 45 million hectares could be irrigated. Since there is a good deal of confusion about the data on irrigation potential, periodical surveys in this respect are likely to be undertaken soon.

Surface Water : The average annual surface water resources of India are now placed at a total of about 168 million hectare metres. Of this, only about 56 million hectare metres can be used for irrigation on account of physiographical conditions. Upto 1951, 9.5 million hectare metres or about one-sixth of the usable flow had been utilized. By the end of the Third Plan, the volume of utilization increased to 18.5 million hectare metres or nearly one-third of total availability. It is estimated that during 1966—69, the utilization is estimated to have increased by another 2 million hectare metres. It is proposed, during the Fourth Plan, to bring about an additional utilization of 5 million hectare metres under major, medium, and

minor schemes, bringing the total utilization to 25.5 million hectare metres or 46 per cent of the usuable flow.

The ultimate area that can be irrigated from major, medium and minor schemes (excluding groundwater) by using 56 million hectare metres of water has been assessed at 60 million hectares.* Further, more intensive investigations in different States might indeed reveal that this figure is somewhat on the low side. For the present, however, the country's irrigation potential may be placed at 45 million hectares through major and medium irrigation and 15 million hectares through minor irrigation. At the beginning of the First Plan, irrigation from major and medium works was 9.7 million hectares and from minor, 6.4 million hectares. The potential expected to be created by 1968-69 from major and medium schemes is 18.6 million hectares and from minor schemes 8·1 million hectares. The balance of potential that can be created is 26 million hectares through major and medium schemes and about 7 million hectares through minor schemes.

Groundwater : It is estimated that about 22 million hectare metres of groundwater can be exploited for irrigation purposes to serve 22 million hectares. At the beginning of the First Plan, 6.5 million hectares had been developed. This increased to 8.2 million hectares at the beginning of the Third Plan. It is expected to reach 10.9 million hectares by 1968-69 leaving a balance of about 11 million hectares (Table VIII).

There is a need to re-examine the underground water resources also. Thus the Indo-Ganga plains are known to be several thousand metres deep and the entire plains are thus capable of being covered by conventional wells or tube-wells for irrigation purposes. The total cropped area of the Punjab, Haryana, Uttar Pradesh and Bihar alone is around 60 million hectares. Then there are large coastal areas of Andhra Pradesh and Tamil Nadu and huge areas of Madhya Pradesh, Maharashtra, Gujarat, etc., which can also be irrigated with the help of underground water. The available figures may thus turn out to be a gross under estimate when a careful study is made.

Progress of Irrigation : A characteristic feature of the Indian irrigation system is that quite a significant part of it is State-operated. There has been considerable progress in the construction of State canals and tube-wells in the last and present century. However, the area irrigated by minor works such as wells and tanks still predominates in the total irrigated area in the country which exceeds that in any other part of the world.

*All irrigation potential and utilization figures mentioned in this chapter refer to gross areas.

TABLE VIII

Development of Irrigation Potential and its Utilization

(Million Hectares)

	Ultimate potential	*Upto 1950-51*		*Upto 1960-61*		*Upto 1968-69*	
		Potential	*Utilization*	*Potential*	*Utilization*	*Potential*	*Utilization*
Surface water	60	16.1	16.1	21.0	19.7	26.7	25.1
(i) Major and medium	45	9.7	9.7	14.4	13.1	18.6	17.0
(ii) Minor	15	6.4	6.4	6 6	6 6	8.1	8.1
Groundwater (minor)	22	6.5	6.5	8.2	8.2	10.9	10.9
Total	82	22.6	22.6	29.2	27.9	37.6	36.0

Note : In the case of minor irrigation, utilization has been assumed to be the same as potential, as actual utilization figures are not available.

Source : Fourth Five Year Plan, 1969-74, p. 247.

Irrigation practices in the country can be traced to the prehistoric period although substantial development took place only during the nineteenth century. The pace has further been accelerated during the era of development planning. Irrigated area increased from about less than a million hectares in 1800 to about 22.6 million hectares in 1950-51 on the eve of the First Plan.

India embarked on planned economy in 1951. Although during the years after the Second World War some reconstruction schemes in irrigation were taken up for construction, a dynamic policy for irrigation can be said to have started only with the initiation of the First Plan in 1951. The irrigation development programmes assumed vital importance with the introduction of multi-purpose schemes which combined generation of power with irrigation.

Formerly, the irrigation canals were mostly inundation ones. With the arrangements for acquaducts, water lifts and multi-stage diversion dams, the benefits of irrigation could be made available to areas with varying ground elevations. Generation of power together with canal irrigation, reduced the cost of irrigations and some works which were considered non-paying, became remunerative. There is an addition of nearly 50 per cent in the irrigated area during a period of 17 years from the beginning of the First Five Year Plan (Table IX). This shows that the progress made in a short period of 17 years is roughly equal to half of what could be achieved during a period of one and a half entury.

While the total area under canals has increased only by about 25 per cent, major improvements have taken place in the area under wells. Tube-wells which were more or less non-existant on the eve of the First Five Year Plan, provided irrigation for an area of over 2 million hectares during 1967-68. There has been a phenomenal increase in this area since then.

The popular demand for groundwater schemes, namely, dug-wells, tube-wells and pump sets have been given priority in the past few years as these works provide the nuclei for high yielding varieties, not only in dry areas but also in the canal irrigated areas (the canal supply alone being inadequate for meeting the time bound requirements for irrigation of the high yielding varieties). During 1970-71, about 2.65 lakh electric pump sets, 1 lakh private tube-wells and 1,000 State tube-wells were to be installed. This would mark an advance over the achievement in the previous year, which amounted to installation of about 2.6 lakh electric pump sets, 90,000 private tube-wells and 800 deep tube-wells. In addition, about 1.70 lakh dug-wells were to be constructed during 1970-71.

So far, initial scrutiny from the hydro-geological angle of the groundwater schemes on an area basis has been carried out only

TABLE IX

Irrigated Areas Source-wise : All-India

(Thousand Hectares)

Particulars	*1950-51*	*1955-56*	*1960-61*	*1964-65*	*1965-66*	*1967-68*	*1968-69*
Government canals	7,158	8,025	9,153	9,953	9,827	10,279	
Private canals	1,137	1,360	1,200	1,136	1,133	1,025	
Tanks	3,613	4,423	4,555	4,760	4,441	4,599	
Wells	5,978	6,739	7,284	7,910	8,445	9,264	
Other sources	2,967	211	2,436	2,508	2,595	2,356	
Total net irrigated area	20,853	22,758	24,634	26,267	26,441	27,091	27,864
Gross irrigated area	22,563	25,642	27,941	30,414	30,922	33,014	33,832
Irrigated area sown more than once	1,710	2,884	3,307	4,147	3,481	5,923	5,768

in respect of schemes refinanced by the Agricultural Refinance Corporation. It has been suggested to the State Governments that such scrutiny should also be exercised in the case of schemes financed by Land Development Banks, Central Co-operative Banks and Commercial Banks under their normal programme. Further, the States have been asked to provide boring and drilling facilities to the cultivators on commercial lines.

Central Groundwater Board : The expansion of groundwater development programme called for intensive coordinated efforts for scientific groundwater investigations. An important step in this direction was the creation of the Central Groundwater Board in place of the Exploratory Tube-wells Organization which had been carrying out groundwater exploration for the last 15 years. While the Board will continue to undertake deep drilling wherever it is considered necessary for exploratory purposes, its primary function now onwards will be to conduct resource evaluation studies in representative areas with a view to establishing the limit of safe pumping. The Board will also extend its exploratory activities in hard rock areas. A survey project is being taken up by the Board with the assistance of Canadian International Development Authority in the hard rock areas of Andhra Pradesh. A few more projects are planned to be taken up in other hard rock areas in Maharashtra, Madhya Pradesh and Karnataka.

A project for water resource evaluation of the Narmada Basin is also to be taken up shortly.

Groundwater Organizations in the States : The sharp expansion of groundwater development has called for commensurate organizational efforts. If the States are to take full advantage of the unprecedented opportunities opened up for financing their groundwater development programme, they would have to strengthen immediately their groundwater organizations so as to ensure that not only compact area schemes are drawn up on the basis of scientific hydro-geological data but that such schemes are also sanctioned and implemented expeditiously.

Autonomous Tube-well Corporations : There are certain areas in the country where groundwater is available only at very great depths upto 300 meters and more in some cases—and can therefore be tapped only at a considerable expense. Also, there are several locations where larger river pumping schemes would be far more economical than individual installations. The development of irrigation in such areas as well as in areas where large size community works are needed to cater to the needs of small farmers, can perhaps best be done by autonomous corporations. These corporations can mobilize institutional finances for financing their new additional programmes. Haryana, Punjab and Gujarat have already set up such corporations.

Groundwater Legislation : Considering the situation emerging as a result of the spectacular expansion of groundwater in recent years, the Conference of Commissioners of Agricultural Production 1969, strongly recommended that the Government of India should formulate and circulate a model bill for control and regulation of groundwater. A model bill has been circulated to the States for passing suitable legislation.

Irrigated Area : The latest available data for 1967-68 indicate that gross irrigated area in the country has increased by 46.8 per cent and the percentage of the irrigated area to gross cultivated areas has increased from 17.1 to 20.3 percent during the period 1950-51 to 1967-68 (Table X). Recently there has actually been a good deal of emphasis on minor irrigation as a result of the implementation of the new strategy for agriculture. During the Fourth Plan period, an additional 12.54 lakh tube-wells and pump sets are likely to be energized bringing the total figure to well over 23·37 lakhs as against 5·13 lakhs at the end of the Third Plan. In Tamil Nadu alone, 5.5 lakh irrigation wells representing over one-third of the total number of wells in the country and providing irrigation for over 640,000 hectares have already been connected to power. The Electricity Board proposes to energize, on an average 60 thousand pump sets each year.

About 2 million hectares of additional irrigation potential created under major and medium irrigation projects in the country remains unutilized for one or the other reason. As against 9.7 million hectares of irrigation potential achieved under the Plans upto 1969-70, the potential actually utilized is stated to be only about 7.9 million hectares.

With regard to the distribution of irrigated area, as much as 63.6 per cent of the total cropped area in the Punjab was irrigated during 1967-68. The corresponding figures for Tamil Nadu, Jammu and Kashmir, Andhra Pradesh and Uttar Pradesh were 47.5 per cent, 37.2 per cent, 31.0 per cent and 28.0 per cent respectively. Madhya Pradesh and Maharashtra with 5.9 per cent and 7.7 per cent respectively are at the end of the list of irrigated area. From among all the States, Madhya Pradesh was the only one where the share of gross irrigated in the total cropped area remained unchanged at 5.9 per cent during the planned period of 17 years.

In the increase in the gross irrigated area during this period, Punjab tops the list with an increase of 253.2 per cent followed by Gujarat with 224.7 per cent, Haryana 176.8 per cent and Karnataka by as much as 97.5 per cent. Orissa with 10.8 per cent increase is the lowest on record and next comes Assam with 12.9 per cent followed by Jammu and Kashmir with 14.4 per cent increase (Table XI).

TABLE X

All-India Irrigated Area and Total Area Under Crops

('000 Hectares)

All-India	*1950-51*	*1960-61*	*1964-65*	*1967-68*
(1) Rice				
Total area	31,056	34,056	36,359	35,983
Irrigated area	9,844	12,523	13,556	13,861
% Irrigated	31.7	36.8	37.3	38.5
Share of the total irrigated area	43.6	44.7	44.2	41.8
(2) Jowar				
Total area	15,554	18,426	18,023	17,902
Irrigated area	473	655	680	707
% Irrigated	3.0	3.6	3.8	3.9
Share of the total irrigated area	2.1	2.3	2.2	2.1
(3) Wheat				
Total area	10,010	12,931	13,453	14,854
Irrigated area	3,256	4,233	4,945	6,457
% Irrigated	32.5	32.7	36 8	43.5
Share of the total irrigated area	14.4	15.1	16.1	19.5
(4) Other Cereals				
Total area	5,576	4,997	4,803	5,075
Irrigated area	248	113	108	199
% Irrigated	4.4	2.3	2.2	2.3
Share of the total irrigated area	1.1	0.4	0.3	0.4
(5) Pulses				
Total area	2,228	2,429	2,560	2,654
Irrigated area	11	12	14	12
% Irrigated	0.5	0.5	0.6	0.5
Share of the total irrigated area	0.1	0.04	0.1	0.04
(6) Total Foodgrains				
Total area	101,196	115,564	118,419	121,079
Irrigated area	18,317	22,055	23,443	26,104
% Irrigated	18.1	19.1	20.2	21.6
Share of the total irrigated area	81.2	78.9	78.0	78.8
(7) Cotton				
Total area	5,655	7,610	8,359	7,715
Irrigated area	465	967	1,292	1,285
% Irrigated	8.2	12.7	15.4	16.6
Share of the total irrigated area	2.1	3.5	4.2	3.9
(8) Ground-nut				
Total area	4,406	6,467	7,375	7,709
Irrigated area	—	195	217	413
% Irrigated		0.7	0.7	1.2
(9) Sugar-cane				
Total area	1,757	2,417	2,606	2,069
Irrigated area	1,183	1,674	1,862	1,530
% Irrigated	67.3	69.3	41.3	73.9
Share of the total irrigated area	5.2	6.0	6.1	4.6
(10) Total				
Total area	131,893	152,772	159,229	163,026
Irrigated area	22,563	27,980	30,704	33.132
% Irrigated	17.1	18.3	10.0	20.3

TABLE XI

Area Sewa and Irrigated State-wise—1950-51 and 1967-68

Area : '000 Hectares

States	Year	Area Sown		% Change in total Gross Area Sown	Area Irrigated		% Charge in Gross Area Irrigated	7 as % of 4
		Net	Gross		Net	Gross		
1	2	3	4	5	6	7	8	9
Andhra Pradesh	1950-51	9,806	10,631		2,318	2,507		23.5
	1967-68	11,367	12,794	(+) 20.3	3,089	3,972	(+) 58.4	31.0
Assam	1950-51	2,225	2,555		542	542		21.2
	1967-68	2,393	2,907	(+) 13.8	612	612	(+) 12.9	21.1
Bihar	1950-51	8,541	10,508		2,078	2,078		19.8
	1967-68	8,284	10,895	(+) 3.7	2,011	2,461	(+) 18.4	22.6
Gujarat	1950-51	6,910	7,195		350	359		5.0
	1967-68	9,802	10,420	(+) 44.8	1,108	1,166	(+) 224.7	11.2
Haryana	1950-51	2,982	3,470		568	643		18.5
	1967-68	3,514	5,150	(+) 48.4	1,132	1,780	(+) 176.8	34.6
Jammu and Kashmir	1950-51	621	647		261	263		40.6
	1967-68	675	808	(+) 24.9	278	301	(+) 14.4	37.2
Kerala	1950-51	1,736	2,013		301	321		15.9
	1967-68	2,129	2,758	(+) 37.0	411	572	(+) 78.2	20.7
Madhya Pradesh	1950-51	14,014	15,390		892	909		5.9
	1967-68	17,797	19,653	(+) 27.7	1,143	1,162	(+) 27 8	5.9
Maharashtra	1950-51	16,298	16,744		801	888		5.3
	1967-68	18,267	19,197	(+) 14.7	1,476	1,481	(+) 66.8	7.7
Karnataka	1950-51	9,326	9,604		613	617		6.4
	1967-68	9,987	10,417	(+) 8.5	1,082	1,219	(+) 97.5	11.7

(Contd.)

TABLE XI *(Contd.)*

Area Sown and Irrigated State-wise—1950-51 and 1967-68

Area : '000 Hectares

States	*Year*	*Area Sown*		*% Change in total Gross Area Sown*	*Area Irrigated*		*% Change in Gross Area Irrigated*	*7 as % of 4*
		Net	*Gross*		*Net*	*Gross*		
1	2	3	4	5	6	7	8	9
Orissa	1950-51	5,657	5,991		1,019	1,029		17.2
	1967-68	5,989	7,446	(+) 24.3	977	1,141	(+) 10.8	15.3
Punjab	1950-51	3,822	4,589		1,245	1,368		29.8
	1967-68	3,992	5,441	(+) 18.6	2,333	3,464	(+) 253.2	63.6
Rajasthan	1950-51	9,715	10,218		1,191	1,316		12.8
	1967-68	15,097	16,657	(+) 63.0	1,865	2,141	(+) 62.6	12.8
Tamil Nadu	1950-51	5,107	5,804		1,181	2,216		38.1
	1967-68	6,085	7,309	(+) 25.9	2,629	3,476	(+) 56.8	47.5
Uttar Pradesh	1950-51	16,231	19,960		4,840	5,219		26.1
	1967-68	17,467	22,709	(+) 13.8	5,657	6,352	(+) 21.7	28.0
West Bengal	1950-51	5,156	5,773		1,176	1,195		20.7
	1967-68	5,569	6,653	(+) 15.2	1,473	1,499	(+) 25.4	22.5
Other States	1950-51	599	798		70	98		12.3
	1967-68	1,290	1,797	(+) 125.1	242	333	(+) 239.8	18.5
Total India	1950-51	1,18,745	1,31,891		20,853	22,563		17.1
	1967-68	1,39,702	1,63,026	(+) 23.6	27,523	33,132	(+) 46.8	20.3

Crops Irrigated: There has been a good deal of change in the utilization of irrigation as between various crops, although the share of foodgrains in the total irrigated area of the country was reduced from 81.2 per cent in 1950 to 78.8 in 1967-68. Cotton improved its position during this period from 2.1 to 4 per cent but other cash crops failed to attract irrigation facilities. While the share of rice declined from 43.6 to 41.8 per cent, that of wheat improved from 14.4 to 19.5 per cent during this period. The position with regard to coarse grains and pulses, however, remained as bad as before. The share of irrigated area during 1967-68 under wheat has steadily increased to 43 5 per cent against 38.5 per cent for rice and 26.1 per cent for all foodgrains. From among the cash crops, sugar-cane had 73.9 per cent of the area irrigated followed by cotton at 16.6 per cent during 1967-68.

Tamil Nadu and Andhra Pradesh were the only two States in the country where over 90 per cent of rice was irrigated in 1967-68. Next were Jammu and Kashmir and the Punjab with 86.8 per cent and 81.8 per cent respectively. With regard to irrigated wheat, the Punjab again topped the list with 70 per cent followed by Gujarat with 63.8 per cent, Haryana 60.5 per cent, Rajasthan 59.8 per cent and Uttar Pradesh 50.9 per cent against the all-India figure of 43.1 per cent. In respect of all foodgrains too there were only three States, Punjab, Tamil Nadu and Kerala where over 50 per cent of the area under foodgrains was irrigated. Corresponding figures for Andhra Pradesh were 37.3 per cent, Haryana 30.3 per cent, Jammu and Kashmir 32.7 per cent and Uttar Pradesh 26.3 per cent. Madhya Pradesh and Maharashtra were the only two States where the share of irrigated area in total foodgrains was only 6.1 and 7.1 per cent respectively.

Sugar-cane is another important crop where 100 per cent of the area was irrigated in Karnataka and over 95 per cent in Tamil Nadu, Rajasthan, Maharashtra, Gujarat and Andhra Pradesh. Bihar is the only State where 27.3 per cent of sugar-cane area was irrigated. In no other State is the irrigated area for sugar-cane less than 50 per cent. Over 90 per cent of the cotton crop in the Punjab and Haryana is irrigated. The figures for Uttar Pradesh are 89.2 per cent and for Rajasthan 72.3 per cent. Tamil Nadu had only 24.2 per cent of the cotton area irrigated and States like Andhra Pradesh, Maharashtra and Madhya Pradesh had only 2 to 4 per cent of the area irrigated (Table XII).

Irrigation Costs: The cost of completing irrigation projects under various stages of construction has increased by about Rs. 250 crores over the past three years. As against the increased costs, the provision made for major and medium irrigation projects in the Fourth Plan is only Rs. 954 crores. Following the rise in the cost of projects subsequent to the formulation of the State Plans, the Union Ministry

TABLE XII

State-wise Total Area, Irrigated Area and Percentage Irrigated under Important Crops : 1967-68

State	Rice			Wheat			Others			Total Foodgrains		
	Total	Irrigated	% Irrigated	Total	Irrigated	% Irrigated	Total	Irrigated	% Irrigated	Total	Irrigated	% Irrigated
Andhra Pradesh	3,399	5,154	92.8	14	4	28.6	5,822	290	5.0	9,233	3,448	37.3
Assam	2,083	571	27.4	7	—	—	117	6	5.1	2,207	577	26.1
Bihar	5,255	1,750	33.3	1,054	405	38.4	3,532	139	3.9	9,841	2,294	23.3
Gujarat	514	138	26.8	553	353	63.8	4,004	114	2.8	5,071	605	11.9
Haryana	217	162	74.8	846	512	60.5	2,889	523	18.1	3,952	1,197	30.3
Jammu and Kashmir	227	197	86.8	187	18	9.6	356	37	10 4	770	252	12.7
Kerala	810	460	56.8	—	—	—	55	—	—	865	460	53.2
Madhya Pradesh	4,170	555	13.3	2,661	282	10.6	9,295	145	1.6	16,126	982	6.1
Maharashtra	1,367	300	21.9	891	221	24.8	10,922	420	3.8	13,180	941	7.1
Karnataka	1,135	684	60.3	305	14	4.6	5,789	220	3.8	7,229	918	12.7
Orissa	4,337	981	22.6	15	4	26.7	1,073	46	4.3	5,425	1,031	19.0
Punjab	314	257	81.8	1,804	1,262	70.0	1,465	691	47.2	3,583	2,210	61.7
Rajasthan	95	28	29.5	1,265	757	59.8	11,041	764	6.9	12,401	1,549	12.5
Tamil Nadu	2,669	2,472	92.6	—	—	—	2,405	390	16.2	5,075	2,862	56.4
Uttar Pradesh	4,398	642	14.6	4,970	2,531	50.9	9,916	1,907	19.2	12,284	5,080	26.3
West Bengal	4,714	1,315	27.9	79	27	34.2	833	58	7.0	5,626	1,400	24.9
All-India	36,437	13,861	38.0	14,998	6,457	43.1	69,986	5,786	8.3	12,142	26,104	21.5

TABLE XII *(Contd.)*

State-wise Total Area, Irrigated Area and Percentage Irrigrted under Important Crops : 1967-68

State	*Sugarcane*			*Ground-nut*			*Cotton*			*Gross*		
	Total	*Irri-gated*	*% Irri-gated*	*Total*	*Irri-gated*	*% Irri-gated*	*Total*	*Irri-gated*	*% Irri-gated*	*Total*	*Irrigated*	*% Irri-gated*
Andhra Pradesh	123	120	97.6	1,370	164	12.0	322	10	3.1	12,794	3,972	31.0
Assam	31	—	—	—	—	—	16	—	—	2,907	612	21.1
Bihar	117	32	27.3	5	—	—	1	(a)	(a)	10,895	2,461	22.6
Gujarat	30	28	98.3	2,009	19	Neg	1,650	208	12.6	10,420	1,166	11.2
Haryana	121	102	84.3	15	—	—	241	233	96.7	5,150	1,780	34.6
Jammu and Kashmir	2	1	50.0	—	—	—	1	—	—	808	301	37.3
Kerala	8	4	50.0	14	—	—	7	—	—	2,758	572	20.7
Madhya Pradesh	37	33	89.2	485	—	—	775	5	—	19,653	1,162	5.9
Maharashtra	165	158	95.8	1,044	15	1.4	2,794	57	2.0	19,197	1,431	7.7
Karnataka	93	93	100.0	778	—	—	1,088	42	3.9	10,417	1,219	11.7
Orissa	36	24	66.7	66	—	—	(a)	(a)	(a)	7,446	1,141	15.3
Punjab	127	114	89.6	2,222	27	12.2	420	401	95.4	5,441	3,464	63.7
Rajasthan	20	19	95.0	281	3	1.1	256	185	72.3	16,657	2,141	12.9
Tamil Nadu	142	107	95.5	909	181	19.9	356	86	24.2	7,309	3,476	47.6
Uttar Pradesh	997	673	67.5	428	1	Neg	65	58	89.2	22,709	6,352	28.0
West Bengal	27	17	63.0	—	—	—	—	—	—	6,653	1,499	22.5
All-India	2,047	1,530	74.7	7,553	413	5.5	7,995	1,285	16.1	163,026	33,132	20.3

of Irrigation and Power has assessed that a shortfall of about 6.4 lakh hectares might arise during the Fourth Plan in the six major projects of Nagarjunasagar and Tungabhadra High Level Canal (Stage II) in Andhra Pradesh, Sone High Level Canal in Bihar, Chataprabha (Stage II) in Karnataka, and Ramganga and Gandak in Uttar Pradesh. Some other irrigation projects in Madhya Pradesh, Bihar, West Bengal, Orissa and Kerala, which are also behind schedule are likely to increase the total shortfall to 9.6 lakh hectares in the anticipated additional irrigation potential.

If the target of 3.6 million hectares of an additional irrigated area in the next three years is to be achieved, the outlay on irrigation projects in the Fourth Plan will have to be raised by Rs. 110 crores. So far, Rs. 1,942 crores were spent on various major and medium irrigation projects. A further sum of Rs. 1,426 crores is now estimated to be required for completing the continuing schemes. During the first three Plans and the annual Plans, 76 major and 460 medium irrigation projects were undertaken in various States ; of these only 16 major and 299 medium projects have been completed so far. Work on the remaining projects is to be continued in the Fourth Plan. The total cost of these projects estimated when they were sanctioned was about Rs. 1,940 crores. Although about Rs. 1,765 crores have already been spent, the spillover cost is assessed by the State Governments at Rs. 1,426 crores.

If the Fourth Plan target as envisaged is to be achieved, an additional five million hectares will have to be irrigated under the sanctioned schemes. The revised gross area that can ultimately be irrigated under major and medium projects has been assessed at 51.8 million hectares.

Irrigation Rates : There are mainly four ways of charging the irrigation rate : (1) volume system ; (2) uniform rate system ; (3) differential rates system, crop-wise ; and (4) lease system.

Under the volume system the irrigation charge is levied on the basis of actual quantity of water used. Under the uniform rate system, water rate is charged uniformly, *i.e.*, on the basis of area irrigated without making any differentiation on the basis of crops. Under the differential rates system, the rate differs crop-wise per hectare. Under the lease system, the rates are fixed by mutual agreement between the Irrigation Department and farmers, the period of lease depending upon the period for which the supply of water is assured. The last basis is usually confined to some specific cases and is not a common method of determining the water rates. The most common basis adopted is the differential rate system. To encourage economy in the use of water, the canal charges are reduced to half for lift irrigation as compared with irrigation charges for flow system. Irrigation

water has been supplied free or at concessional rates to popularize it among the farmers for certain farming practices, e.g. growing of green manure or early fodder crops, etc.

In the new irrigation undertakings, the basis of fixing irrigation rates vary. In the Tungabhadra Project, water levies are computed on the basis of net income per acre and the volume of water necessary to bring the crop to maturity. Net income is arrived at on generalizations. No scientific study or analysis has been done for this purpose. In the Hirakud Project, water rates are based on increases in the gross income per hectare. In practice, there is not much difference between this and the net income approach as the latter is not worked out on any well-defined principles. In Bhakra Nangal, water rates are based on the existing occupiers rates.

Irrigation Policy : A total investment of over rupees one thousand crores has been made in major and minor irrigation during the first three Five Year Plans. A proper utilization of water made available at such a heavy cost is, therefore, extremely necessary, particularly when improved varieties of seeds giving high yields would need proportionately larger quantities of water. The Fourth Five Year Plan is alive to the problem. A centrally sponsored scheme for command area (Ayacut) development is in the Plan. This envisages an integrated approach using improved agricultural practices in relation to irrigated farming, co-operation, and development of rural industries.

Existing Problems : (1) There is lack of co-ordination between irrigation and agricultural development. In the State canal system generally the supply of water is not well co-ordinated with its requirements for crops. Changes in cropping pattern and farming practices alter the demand for water both in volume and time of its supply. The irrigation authority takes action to adjust the supply to changes in demand after a considerable time-lag. An extension programme, encouraging a change in land use programme and farming practices, use of fertilizers, etc., depends a great deal on an efficient irrigation service. Similarly, it is also true that development of irrigation depends a great deal on an effective planning of crop rotations and farming practices. But neither have gone hand in hand. Consequently, a proper use of irrigation facilities has been quite a delayed process. In an accelerated progamme of irrigation development, under the Five Year Plans, attention has been drawn to this shortcoming because of wide gaps between the targets and the actually irrigated areas.

(2) Water rates have not been determined on a scientific basis.

(3) There has been inadequate attention to drainage needs. Canal and road construction interferes with natural drainage places. Canal irrigation works were constructed in areas having wells where

the canal substituted to a large extent the well-irrigation. Instead of encouraging wells as a supplementary means of irrigations, in some States, the construction of wells was even prohibited in the canal commands. Such restrictions have now been removed. Under the Plans, an attempt has been made to fix priorities between the major and minor works on the basis of cost and return ratio for the first time. Unfortunately, wells and tanks have been put together for the calculation of cost and return ratio of the minor irrigation works. The result has been that the calculations show that the returns per unit of investment from the minor projects are lower than the major projects. This led to a wrong emphasis on major works. The return has also not been worked out on any scientific basis. Lack of attention to a proper basis for calculating the cost and return ratio, lack of data needed for such calculation, disregard to difference in the time factor in the availability of irrigation, the relative sizes of investment needed, and the combining of wells and tanks into one for estimating the cost and return ratio from minor irrigation works, led the planners to an irrigation policy which experience revealed far from right. Since then, emphasis has been placed on minor irrigation projects.

(4) Canals have also aggravated the problem of floods every year despite anti-flood measures and construction of dams. The river flow is slowed down, silt deposit increases and the river bed becomes shallow, reducing the capacity of rivers to drain the surplus rain water. Rivers are the most effective natural drainage systems, and any unplanned interference with them is bound to have its repercussions on the natural drainage and, therefore, on the incidence of floods in a country with the rainfall concentrated in short periods.

(5) Planned research is necessary on water requirements of crops under different soil conditions and farming practices.

Advisory Panel on Irrigation : The Union Government has set up a 13-member Advisory Committee on irrigation, flood control and power projects headed by the Secretary to the Ministry of Irrigation and Power. The Committee will examine irrigation, power, flood control and other river valley projects proposed by the State and Union Governments and other authorities and advise the Commission and the Ministry of Irrigation and Power on the merits of individual projects. While work on some schemes may commence in the Fourth Plan period, their implementation may be spread over the subsequent Plans.

The Committee will examine whether the schemes have been prepared after detailed investigations, whether they are technically sound, and if the estimates are complete and correct, it will scrutinize whether the financial forecasts and the estimates of benefits to be

derived are based on accurate data. With regard to power generation schemes, the Committee will examine whether they have been prepared so as to fit into the load characteristics of the region and serve the regional requirements as a whole. The Committee will also see if each scheme has been examined from the inter-State angle and if there is agreement between the States concerned in respect of schemes in which the interests of more than one State are involved. It will determine the procedure for receiving schemes from Central and State Governments.

River Basin Plans : For integrated development of water and land resources, Master Plans have to be drawn up for long-term development of irrigation in each river basin, including inter-State rivers. In preparing these plans, the optimum economical development of a river basin has to be kept in view, covering various aspects such as irrigation, flood control, navigation, and oil conservation. The development of groundwater resources would also need to be co-ordinated. Such development would often run across State boundaries. Works would have to be executed in a State other than the one in which the benefit will result. Preparation of a few basin-wise plans will be taken up in the Fourth Plan so that future schemes dovetail into these plans.

Research in irrigation, hydraulics, soil mechanics, and construction materials is being conducted in the Central Water and Power Research Station at Poona, the Central Soil Mechanics Concrete Research Station at Delhi, and other research stations in different States. These stations are engaged in applied engineering and fundamental research. The research programmes are co-ordinated by the Central Board of Irrigation and Power. With the larger programmes of development now being undertaken, the activities of these organizations will be broadened in the Fourth Plan.

Panel on Water Resources : A panel on water resources has been set up which will advise, in the light of scientific and technological considerations, on long-term planning of water resources, including their assessment, exploitation, and conservation. It will recommend the lines of research and investigation necessary for the integrated use of surface and groundwater resources. It will also consider other important aspects such as water-logging and salinity. As a step towards long-term planning, the panel will indicate priorities in the survey and exploitation of water resources, both surface and underground. For the optimum utilization and conservation of these resources, and for intensifying agricultural productivity, it has been recognized that proper distribution and management of water on the field is essential through measures such as land shaping, construction of field channels, and provision of adequate drainage.

Apart from the panel, attention is being given to studies and investigations designed to improve the efficiency of water management, public and private, with due regard to all the relevant factors such as soil conditions, plant-water relationship, farm practices and farm management.

Minor Irrigation Corporation : The Union Agriculture Ministry has mooted a Minor Irrigation Corporation on the lines of the Rural Electrification Corporation. The scheme envisages creation of a special fund of Rs. 150 crores for financing minor irrigation works like tube-wells, lift irrigation and storage tanks. Part of the money may be provided by the Union Government and the rest by the United States Agency for International Development out of the P.L. 480 rupee resources. The special fund, it is proposed, may be utilized to sanction long-term loans for selected viable irrigation projects. The rapid loans and the interest earned may be recycled on a continuing basis to refinance minor irrigation works. The State Governments may be required to guarantee the repayment of the loans and the interest so that the security and revolvement of the Corporation funds are assured.

The total outlay earmarked for minor irrigation schemes in the Fourth Plan is Rs. 468 crores. Of this, about Rs. 200 crores are accounted for by contributions towards debentures of institutional agencies, subsidy, direct loans and purchase of equipment. The balance of Rs. 268 crores is left for State works, including surface water flow irrigation projects, lift irrigation projects and tube-wells.

Special Fund for Minor Irrigation : The Agricultural Refinance Corporation, (ARC) established eight years ago to refinance the long and medium-term requirements of agricultural credit institutions, has upto June 30, 1971 committed Rs. 248.66 crores of which Rs. 16.68 crores are for minor irrigation. The assistance covered 458 schemes of which the share of ARC was 71.4 per cent. The total number of schemes sanctioned by ARC during 1970-71 was 100 involving financial assistance of Rs. 62.15 crores of which its share was Rs. 53.92 crores.

The total amount of refinance drawn from ARC as on June 30, 1971 amounted to Rs. 89.71 crores, of which Rs. 81.25 crores were drawn by the Central Land Development Banks, Rs. 4.42 crores by Commercial Banks and Rs. 4.04 crores by the State Co-operative Banks.

States like Kerala, Orissa, West Bengal and Assam have drawn little or have lagged behind in availing themselves of funds sanctioned by ARC. In its help to small farmers, ARC's programme includes two schemes—one in Haryana and another in West Bengal. The scheme in Haryana envisages the construction of 170 deep tube-wells

in Ambala district. The West Bengal scheme envisages the construction of 300 shallow tube-wells in three blocks in the Hooghly district.

To broadbase its activities, ARC has decided to concentrate on dry farming projects with the aim of helping small farmers. It has also agreed to meet the full cost of loans of the Commercial Banks which take up emergency well digging programmes in areas affected by drought or other natural calamities.

Irrigation Commission : The Irrigation Commission set up by the Union is under Ajit Prasad Jain. Its terms of reference are to : (1) review the development of irrigation in India since 1903 when the last Irrigation Commission made its report and the contribution made by irrigation by increasing the productivity of land and in providing insurance against the vagaries of rainfall; (2) examine the irrigation facilities available in chronically drought affected and food deficit areas and suggest essential and minimum irrigation works to be undertaken in them; (3) draw up a broad outline development of all types of irrigation for achieving self-sufficiency in cereals and for maximizing the production of other crops and make a broad assessment of funds required; (4) examine the adequacy of water supply in major irrigation projects; (5) examine the administrative and organizational set up for the planning, execution and operation of irrigation works, particularly to speed up completion of projects and reduce their gestation period; (6) suggest criteria for sanctioning irrigation projects and (7) examine other matters, related to the development of irrigation in the country and make suitable recommendations.

V. Soil Conservation and Dry Farming

Soil conservation measures in practice are designed to improve the soil and raise its productivity. The programme is, in fact, an integrated approach to the proper use and care of the land, using the technical knowledge of various branches of agriculture relevant to the problem in each specific case. No doubt it is a major effort against prevention of erosion and loss of soil, but the recent advances in soil conservation have considerably enlarged its scope which includes land use planning and improvement in soil structure and fertility, in addition to anti-erosion measures such as terracing, contouring, strip cropping, filling gullies, or planting excessively steep or erodable land with grass and trees. It also covers drainage of wet lands and irrigation of the dry ones; and addition of fertilizer and organic matter if the soil is deficient in them. The term soil conservation is now becoming synonymous with soil management.

Soil Erosion : Soil erosion is the process by which soil particles are transported from one place to anotber through the agency of wind or water in motion. Experiments conducted at different research

stations in the country have indicated a soil loss of at least 50 tonnes per hectare on cultivated land with one per cent slope against a soil loss of 1.25 tonnes on land with natural vegetation. The total energy of rain drops has been calculated as being roughly equal to 250 horse power over a hectare during a rainfall of 2.54 cm. which has sufficient force to lift nearly 18 cm. of top-soil layer to a height of over 90 cm. 86 times during an hour's rain. Suitable measures to control erosion comprise vegetative cover, rotation of crops, strip-cropping, terracing, contour cultivation, listing, drainage shelter-belts, deferred grazing, etc.

Early History of Soil Erosion : Soil erosion in its different forms and shapes has been going on for centuries. Classic examples are those of the now buried mighty civilizations of Babylonia and Assyria. If an example is required in India itself, one only has to see the ruins of Taxila and Harappa. There was a time when Bijapur was the capital of a flourishing kingdom. It is now a picture of devastation. Famines are its recurring feature. Evidence shows that as early as the time of Alexander the Great, there were thick forests and well populated cities in the north of Kutch and the south of Punjab which now form a part of the Rajasthan desert. All this happened because of wind erosion as a result of the abuse of land. Surat was, in living memory, a large commercial city. Its population during the last 50 years has come down appreciably. This is because the river Tapti has become unnavigable as a result of sedimentation caused by erosion in the uplands.

The Rajasthan desert which already covers an area of about 2.00,000 sq. kilometres is advancing towards the Ganga Plain at the rate of about 800 metres a year over a front of about 1,600 kilometres. The beautiful Nilgiris, the hillsides of the Himalayas in Kumaon and the Shiwaliks from the Punjab to Assam are also being fast eroded for want of afforestation.

Today, according to available estimates, about 50 million hectares of land in India are affected either by soil erosion or exhaustion caused by unplanned cutting of forests and bad farming. A random soil survey also reveals that 71 per cent of the area in the scarcity tract has been severely eroded and 26 per cent has been rendered useless for agricultural purposes. If nothing is done to arrest this recurring loss, reclamation of new areas provides no solution to the land problem in India because the losses by erosion will far exceed the gains. Soil erosion is caused mainly by unplanned removal of forest cover in the upper reaches, indiscriminate grazing of vegetation especially during the summer months, and wrong methods of cultivation on sloping lands without necessary protection.

In course of time, from an unnoticeable event in the beginning, soil erosion becomes a menace and deep gullies are formed. The

fertile top layer is gone. The soil becomes poor and less productive and ultimately refuses to respond to any cultivation. Troubles do not end with loss of productive power or unproductive farming. River beds become shallow. They lose their efficiency as natural drainage channels, incidence of flood increases devastating vast areas year after year. To poor yields is added the destruction of crops and loss of cattle and human lives. Navigability of rivers is greatly reduced. Because of shallow beds, the rivers' capacity to hold water during dry months is much less, causing further hardships in the supply of irrigation and even drinking water in many areas. It has been truly said that "civilization is rooted in the soil". The destruction of soil leads to destruction of the very root of civilization. Soil conservation is thus of interest not only to a physical scientist but is also a matter of great concern to social scientists as well.

Public attention was drawn to the menace of erosion in India by Glover in 1944. Sir James Penny, the then Financial Commissioner of the Punjab pointed out the importance of common grazing grounds which had been destroyed. A team of American Soil Conservation Specialists on its way back from China toured India. It explained at length how agricultural engineers, foresters, agronomists, range managers, biologists, soilmen, farm managers and above all the farmers themselves had worked collectively in the U.S.A. to fight this national scourage. The basic unit of planning in the U.S.A. was a single farm which, on an average, approximates 57 hectares, but the team favoured a village as a basic unit of planning for purposes of demonstration in India.

The team further recommended a soil and water conservation law and the creation of a service similar to the Soil Conservation Service of the United States Department of Agriculture. No piecemeal solution of the problem was possible. An Indian team which visited the U.S.A. in 1947 pointed out that the farmers could adopt soil and water conservation practices if they were shown in a practical way that these measures not only prevented soil deterioration but also paid substantial dividends. The team recommended that the entire village should be used as a unit of planning. This would illustrate better how certain conservation practices such as drainage or terracing, which cannot be effectively applied to small individual parcels of land, can be used on a co-operative basis ignoring the ownership boundaries.

Training and education programmes in soil conservation were emphasized. The intention was not to treat soil conservation as a separate subject, but to integrate the simple principles of sound land use with other scientific subjects, so as to make the future generation conservation minded.

Legislation : India can be proud of being one of those countries which has the earliest legislation on soil conservation. This problem is as old as agriculture itself. It is only in recent years that it received some attention from both Central and State Governments in this country. One of the first laws for the prevention of soil deterioration was passed in 1904 in the Punjab under the Land Preservation Act. The Act provided for such measures as *wat bandi*, contour trenching, gully plugging, terracing, tree planting, preservation of forests, etc., for preventing the havoc caused by the torrents. Systematic soil conservation work commenced only in 1936 when public co-operation was geared to the programme through the creation of co-operative societies.

In Maharashtra, soil conservation work was started in 1939 when the scheme for bunding and dry farming survey and development was sanctioned. The work was further strengthened when the Land Improvement Schemes Act of 1942 was passed and the Cusrow Wadia Fund was created for subsidizing bunding work. As a result, about 600,000 hectares of land were covered with contour bunding by the end of the First Five Year Plan. A similar Act was passed in Madras (Tamil Nadu) in 1949. In Uttar Pradesh, soil conservation measures were taken over from zamindars for erosion control and creation of fuel and fodder reserves.

The First Five Year Plan provided an opportunity for a co-ordinated approach to this programme. It was recognized that various State Governments should be armed with legal authority to overcome any opposition. The Central Government thus reviewed the existing legislation and proposed a Model Soil Conservation Bill on the lines of the U.S. legislation on Soil Conservation Service. The objectives of this Bill were :

1. Conservation and improvement of soil resources.
2. Prevention or mitigation of soil erosion.
3. Protection of land against damage by floods or drought.
4. Reclamation of waste land.

The Model Bill was sent to the State Governments for adoption. Most of the State Legislation is now based on this Model. The broad pattern of the Bill follows the Bombay Land Improvement Schemes Act, as subsequently amended by that Government. It is comprehensive and covers the following aspects :

1. Power to regulate, restrict or prohibit certain matters in the notified areas, inquire into claims and award compensation.
2. Constitution of the State Land Improvement Board and the manner of its working, constitution and functioning of the District Land Improvement Committees.

3. Appointment of an Executive Officer for a scheme under the Act with powers to get work executed by the owners of land at their cost if they are willing or at the cost of the Government subject to subsequent recovery. The executive officer is required to prepare a statement showing the details of the work done, amounts and nature of recoveries to be effected from the owners, responsibility of maintenance and other prescribed particulars. Responsibility for the maintenance of such work is that of the persons enumerated by the Executive Officer. Appeal against the actions under the Act lies with the State Gyvernment whose orders are final and cannot be called to question in any court. The penalty for contravening any of the provisions of a scheme that has come into force is prescribed.

The Act provides for the preparation and execution of schemes for the conservation and improvement of soil resources, prevention of soil erosion, protection of land against damage by floods and drought, reclamation of waste lands, etc. Also State Land Improvement Boards and District Land Improvement Committees which would be responsible for getting the work done in each State could be set up. These Boards and Committees are empowered to acquire waste land for improvement.

Central Soil Conservation Board : As a result of the increasing awareness of the problems of the soil deteroriation and its impact on the economic stability of the country, the Central Government created in 1953, the Central Soil Conservation Board for co-ordinating work on an all-India basis. Its main functions are to organize, co-ordinate and initiate research on soil conservation, to meet the paucity of trained personnel for manning soil conservation schemes and to assist State and River Valley Projects technically and financially, by advancing loans and giving subsidies, to carry out their soil conservation programmes. The Board gives financial assistance to private farmers only through State Governments and River Valley Project authorities.

During the First Five Year Plan, the Board worked out a programme to extend soil conservation measures to about 200,000 hectares. More recently it drew up a phased programme to cover about 80 million hectares by the end of the Seventh Plan period.

Research and Training : The Central Soil Conservation Board has established ten research centres one each at Dehra Dun, Kotah, Ootacamund, Bellary, Vasad, Agra, Chandigarh, Chhatra, Jodhpur and Ibrahimpatnam. The centres at Dehra Dun, Chandigarh and Chhatra deal with erosion problems in the hills in the Himalayas in the Punjab, Himachal Pradesh and Uttar Pradesh. The Ootacamund

centre investigates problems on hill-side erosion in the Nilgiris, particularly in relation to heavy rainfall conditions. The centres at Agra, Kotah and Vasad have undertaken work on conservation of ravine areas in Uttar Pradesh, Madhya Pradesh, Rajasthan and Gujarat. Stabilization of marginal lands and gullies in alluvial soils forms the main plank of investigation at these centres. Soil conservation problems of deep black soil of Maharashtra, Tamil Nadu, Andhra Pradesh and Karnataka are investigated at Bellary, while the centre at Jodhpur deals mainly with problems of drifting sand and methods of desert control. The newly started station at Ibrahimpatnam will look after the problems of red soil. Some of the States also have Soil Conservation Research Stations which deal with specific problems.

Soil conservation research work carried out at various research stations covers the different fields in associated disciplines of hydrology, engineering, forestry, agrostology, agronomy, soil sciences, etc. Small defined watersheds under different land use managements like forestry, grasslands, cultivation, etc., are being calibrated to study runoff and soil loss patterns. Runoff and soil loss studies are being made under various soil conservation treatments also. Suitable designs for engineering structures to control runoff and soil erosion; suitable tree and grass species for forestry and grassland management; suitable cultural and agronomical practices for cultivated lands; special soil conservation measures for ravine reclamation, gully and torrent control, landslip treatment, etc., are being studied on a regional basis at different research stations.

In order to provide for trained personnel for both research and extension work, the centres at Dehra Dun, Kotah, Ootacamund and Bellary conduct training classes in soil conservation. The course is also conducted at Hazaribagh in co-operation with the Damodar Valley Corporation. At Dehra Dun the courses are held for officers while at Bellary, Ootacamund, Kotah and Hazaribagh, the courses are for assistants.

The Planned Era : The magnitude of the problem was fully appreciated in the First Five Year Plan. The schemes under soil conservation—a pioneer national plan—falls under three heads. In the first category, are schemes aiming at immobilizing deserts. The second refers to measures for bunding and terracing on agricultural land. The third tackles afforestation on ravines and badly gullied lands. The importance of sound and simple soil conservation measures such as contour ploughing—ploughing fields across instead of up and down the slopes—strip cropping, sowing of cover crops like gram, cowpea or ground-nut in strips to prevent the soil being washed away, raising of shelter belts of growing trees to check

encroachment of the desert, mulch farming, bunding, terracing, gully plugging and check damming, hardly needs emphasis.

On the recommendations of the Planning Commission, notable progress has been made in the initiation, organization and co-ordination of soil conservation research, training and action programme on the national level. The Central Board has given technical and financial assistance to the State Governments to develop a sound programme of soil conservation. According to a working concept set by it, soil conservation includes all soil and water management practices that are needed to attain sustained production of cultivated crops, grasses and trees at the highest practical level.

With the experience gained during the Second Plan and a larger number of persons trained in soil conservation, development work during the Third Plan was stepped up considerably. An outlay of Rs. 72 crores was provided for the execution of various programmes and specific targets laid down under different schemes. There was emphasis during the period on additional training facilities for a successful completion of the Plan targets. It was visualized that people's participation in this programme was necessary. Mobilization of local leadership and other measures, therefore, formed an integral part of the Plan. Suitable legislation empowering State Governments to frame soil conservation schemes for the basin of a river or a stream or for groups of villages was recommended.

In the Fourth Plan, soil conservation programmes in conformity with the new approach of integrated Watershed Work Plans and Area Saturation, was adopted. The more important of the soil conservation measures on which greater emphasis was laid included control of soil erosion, protection of land against all forms of soil deterioration, improvement of physical conditions of land, rebuilding of soil fertility, conservation of soil moisture for crop use, proper management practices, etc. Till the end of 1969-70, an area of about 11 million hectares had been treated with soil conservation measures at an estimated expenditure of Rs. 215.2 crores. The programmes of soil and water conservation were taken up in different rainfall zones and special attention was given to land development in dry land farming areas with scanty rainfall as well as creating employment opportunities in such areas.

Work in Catchments of River Valley Projects : The centrally sponsored programmes of soil and water conservation in the catchment of 13 major river valley projects are being intensified in order to prolong the life of the multi-purpose reservoirs which are beset with the problem of high rate of sedimentation. The works were concentrated particularly in watersheds where there was evidence of accelerated erosion. In addition, soil conservation programmes were

initiated in 8 additional river valley projects. In such areas, about 0.1 million hectares were covered during 1970-71. Various measures taken in the river valley project areas are expected to conserve the water storage capacities of irrigation schemes. This centrally sponsored scheme is being executed by the Agriculture and Forest Departments in the respective States. Some State Governments are also undertaking similar programmes with their own resources. The Governments of the Punjab and Bihar have established Soil Conservation Directorates for working the programme under the centrally sponsored and State Sector Schemes. Implementation of both schemes has helped in creating additional employment opportunities for about 12 crore man days.

Ravine Reclamation : Under the Centrally sponsored scheme of pilot projects in Gujarat, Madhya Pradesh, Rajasthan and Uttar Pradesh, an area of 1,200 out of 8,000 hectares is estimated to be reclaimed during 1970-71 at a total cost of Rs. 30 lakhs. The objective of this scheme is to determine the technical and economic feasibility of large scale ravine reclamation. The experience gained in the execution of pilot projects is expected to be utilized by the respective State Governments for taking up large scale ravine control and reclamation works.

Soil Survey : The All-India Soil and Land Use Survey Organization under the Ministry of Agriculture is conducting a standard soil survey in the catchments of 13 river valley projects. The purpose of these surveys is to provide basic information on priority areas for planning and execution of various soil conservation measures. Some soil surveys are also conducted outside the catchment area to find out the suitability of land for agricultural purposes. It is estimated that 2.75 lakh hectares would be surveyed in the catchment areas. Aerial photo-interpretation work has also been initiated in the newly selected 8 river valley projects for the purpose of erosion assessment in these catchments.

In order to establish potential areas for economic agriculture, a centrally sponsored scheme of soil survey in 5 innovative IADP districts, namely, Ludhiana, Sambalpur, Raipur, West Godavari and Thanjavur was initiated during 1969-70. A target of 8 lakh hectares fixed for 1970-71—4 lakh hectares detailed soil survey and 4 lakh hectares reconnaissance soil survery—is likely to be achieved during the year at a total cost of Rs. 7.5 lakhs.

Resources Inventory Centre : The Resources Inventory Centre set up in 1967-68 is engaged in collection, correlation and presentation of available data through maps, charts and reports and highlighting information gaps. Relevant data on soil, water, vegetation, land use and climate are the main disciplines on which the data are being

collected and presented. A technique of sample surveys to enable a quick inventory of land resources has been tested in Indore district and is being refined for wider application. A tentative study on criteria for nation-wise delineation and codification of watersheds has also been initiated.

Other Aspects : A central unit for Soil Conservation (Hydrology and Sedimentation) started functioning during 1970-71 for the collection and correlation of hydrological and sedimentation data with a view to evolving standard design procedures to be used in priority determination and work plan development for the catchments of river projects and other schemes.

Integrated Development of Dry Land Agriculture : The breakthrough in agriculture, which has been achieved in irrigated and assured rainfall areas through the introduction of high yielding varieties and multiple cropping has to be extended to dry areas. Accodringly, a centrally sponsored scheme for Integrated Dry Land Agricultural Development was launched in 1970-71 for implementation during the remaining period/term of the Fourth Five Year Plan. The approach of the scheme consists of (i) intensive research for evolving techniques which will give maximum returns and (ii) practical application of the available knowledge on soil and moisture conservation practices; cultivation of drought tolerant and short duration photo-insensitive varieties of crops, new techniques of fertilization, etc., under pilot project.

It is proposed to take up 24 pilot projects under the scheme which would be training-cum-demonstration projects. To begin with, 9 such projects were initiated during 1970-71 in Andhra Pradesh, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Karnataka, Rajasthan, Tamil Nadu and Uttar Pradesh. Advance action has also been initiated to establish the remaining 15 pilot projects during 1971-72. In view of the special nature of this programme and due to the weak economic position of the farmers, special incentives have been provided. These include subsidies and loans for inputs as well as for permanent works at least in the initial stages. The scheme takes care of infrastructure requirements like demonstrations, farmers' training, use of improved implements, foliar spraying of urea and pesticides, sprinkler irrigation and suitable animal husbandry programmes. Care is taken to ensure that the investment is related to likely returns.

VI. Land Policy

An ideal land system should aim at ensuring the most productive use of land without any damage to it and loss of fertility in the long run. This means that the tiller of the land should enjoy full

security over the land held by him provided he assumes responsibility for its proper maintenance and cultivation. The system of taxes and rent, if the land is not owned, should assure a reasonable reward for his labour and expenditure. There should be necessary incentives and sanctions for investment on improvements in land. Keeping this in mind, it is proposed to examine the land policy from 1947.

Pre-Independence Legislation : In the pre-independence era, piecemeal attempts were made for eliminating some of the worst features of land tenure. The former Government of Bombay enacted in 1938 a law creating a class of protected tenants who could not be evicted except for non-payment of rent and such specific reasons. Rents were also reduced. In Bihar, all rent enhancements between 1911-13 were cancelled and illegal evictions by the zamindars were made a penal offence. In the United Provinces, as Uttar Pradesh was then called, a moratorium was declared on all arrears of rent and debts, and ejectments of tenants were prohibited. When the U. P. Tenancy Act of 1939 came into force, permanent and heritable occupancy rights were given to 7 million tenants over an area of 66 million hectares.

Land Pattern on the Eve of Independence : Various interests in land on the eve of independence fell into four classes : (1) cultivating holders ; (2) intermediaries—non-cultivating holders ; (3) tenants-at-will ; and (4) agricultural labourers.

Cultivating holders may be classified into two categories—owners and tenants. If the owner cultivates the land himself, there is no other person holding interest in his land above or below him and between him and the State. As against this, tenant holders do not have any ownership rights in land. They may more appropriately be described as 'occupancy tenants' to distinguish them from the 'tenants-at-will'. They have no direct relation with the State, but there is a chain of intermediaries. Land tilled by them may have any number of interests above them.

Intermediaries are either non-cultivating owners of land or non-cultivating occupancy tenants. In the Zamindari areas, all interests above the occupancy tenant and below (if he himself was a non-cultivator) can be termed as intermediaries. In the ryotwari areas, owner-holders, not cultivating the land themselves, are intermediaries. They pay a fixed revenue to the State and receive higher rents. As in the case of Bengal, there could be as many as 15-20 intermediaries between the State and the actual tenant or the tiller of the soil.

A tenant-at-will cultivates the land and bears its cost of cultivation. He may or may not have any security of tenure. The land tilled by him can have any number of interests above him. His rights

on the land also differ from region to region. Invariably his interest is not permanent and heritable. But there are examples like those of Bihar, where even the under-ryot, the man at the bottom, can also acquire occupancy rights by a continuous possession of land for twelve years. Agricultural labourers constitute the mass of unemployed and underemployed landless population in the villages. Very few of them are able to secure permanent employment. Some cultivate small parcels of land and may even own the plots but their major source of living is the wages earned. This class always exerts great pressure to obtain land for cultivation.

Land Reforms in Post-Independence Era : On the eve of independence, the social, economic, and political thinking was very favourable for land reform measures, rather the various political groups vied with each other in advocating an overhaul of the land system which would benefit the small holders and landless population. The First Five Year Plan stated that the increase of agricultural production represented the highest priority in planning over the next few years, and agricultural economy had to be diversified and brought to a much higher level of efficiency.

In this context, it was necessary to remove the impediments to agricultural production. Opinion was growing that the first requisite for better farming was a change in the character of the agrarian structure in India. An irrational agrarian relationship could be responsible for (1) a large share of the produce being paid as rent, leaving little incentive to the poor cultivator to increase output; (2) reducing the margin of saving for investment on land or its efficient cultivation in the case of the majority of tenants who are small holders; (3) lack of security of tenure, even in the case of well-to-do farmers and, therefore, no incentive to improve production or invest on land improvement; and (4) no interest in investing on land improvement on the part of absentee landlord who normally has other sources of income as well.

More than a business proposition, agriculture in India is a way of life for more than seventy per cent of the people. No Government wedded to a welfare programme could be indifferent to the status of millions who depend on land. Protection against exploitation, security and equality of status and opportunity among different sections of the rural population, were accordingly accepted as national policy.

Objectives of Land Policy : Broad objectives of land reform measures under implementation and formulation in the country may be summarized as follows :

(1) Land to the tiller,

(2) Augmentation of agricultural production by a better system of land management.
(3) Reduction of inequalities in opportunities and income.
(4) Improvement in the position of agricultural workers.
(5) In general, the raising of living standards in rural areas.

For the fulfilment of these objectives, major steps adopted under the programme are :

(1) Abolition of intermediaries.
(2) Regulation of landlord/tenant relationship by fixing fair rents, conferring security of tenure on tenants subject to the landlord's right to resume a limited area for personal cultivation, bringing tenants into direct relationship with the State in respect of areas which the landlord is not entitled to resume and gradual conferment of ownership rights on the tenants.
(3) Redistribution of land by placing ceilings on future acquisition and existing holdings and acquiring surplus areas above the ceilings, resettlement of landless agricultural workers and increasing the size of uneconomic holdings.
(4) Consolidation of scattered holdings into compact blocks and prevention of fragmentation and diminution of holdings below an economic size.
(5) Development of co-operative farming by which small holdings will be pooled and cultivated jointly to increase the size of the operational unit and benefit from economies of large-scale organization leading ultimately to co-operative village management.

Abolition of Intermediaries : The abolition of intermediaries, though having wider objectives of social equality and economic advancement of the tenant class, gained considerable support when legislation failed to regulate the relations between landlords and tenants. Enactments for the abolition of intermediaries were undertaken in certain States before the formulation of the First Five Year Plan. But most of the work relating to enactment of laws and acquisition of intermediary titles was done during the period of First Plan. Zamindari Abolition Acts were passed in Uttar Pradesh, West Bengal, Madhya Pradesh, Patiala and East Punjab States Union (PEPSU), Rajasthan, Saurashtra and Delhi. Intermediary rights in the States of Uttar Pradesh, Bihar, Punjab and West Bengal have now been completely abolished. Except for a few minor tenures, legislation has been enacted in other States.

Compensation : Since no property can be acquired by the State without compensation to the owners under the Constitution, all Acts for abolition of the rights of intermediaries provide for payment of

compensation and indicate the principles according to which and the manner in which, compensation has to be determined. It is computed on the basis of 'net income' in Assam, Bihar, Madhya Pradesh, Orissa; on 'basic annual sum' in Tamil Nadu and on 'net assets' in Uttar Pradesh.

The 'net assets' and 'net incomes' are calculated by deducting from the usual aggregate incomes, accruing to the landlord from their estates, the aggregate of the expenses incurred by way of pay, cost of management, recoverable arrears of rent, etc. The basic annual sum (as in Tamil Nadu) is calculated on the basis of the gross annual ryotwari demand, average net income derived from *lanka* lands other than those in respect of which ryots of land holders are entitled to ryotwari *patta* and average net annual miscellaneous revenue derived from such sources as waste land, pasture land, forests, mines and minerals, rivers, quarries, fisheries, etc. Deductions are to be made on account of establishment charges, deficiency in collection, maintenance of irrigation works, etc.

Rates of compensation are fixed on a graded scale with higher multiples for smaller incomes and lower multiples for higher incomes. The multiple laid down is eight times in Uttar Pradesh and seven times in Rajasthan and parts of Madhya Pradesh. In Madhya Bharat, now part of Madhya Pradesh, the multiple is eight under the Zamindari Abolition Act and seven under the Abolition of Jagirs Act. In other States the sliding scales are as follows :

Assam	2 to 15 times
Bihar	2 to 20 times
Tamil Nadu	12 to 30 times
Madhya Pradesh (merged territories)	2 to 10 times

In Uttar Pradesh, Madhya Pradesh, including the Madhya Bharat area, where compensation is to be determined at a flat rate, the State also pays a rehabilitation grant to the smaller intermediaries in addition to compensation. Small intermediaries are those who pay land revenue upto Rs. 10,000 in Uttar Pradesh and Rs. 3,500 in Madhya Pradesh including the Madhya Bharat area. For the Madhya Bharat area, it is further laid down that only proprietors who earn livelihood wholly or mainly from agriculture will get rehabilitation grants.

The main problem now engaging the attention of State Governments is the building up of the revenue agency and preparation of land records. In many States this has been completed. Action is still pending in States like Bihar and Orissa. In the country as a whole, about Rs. 320 crores has so far been paid as compensation, out of an estimated total of Rs. 570 crores including rehabilitation grants and interest.

Payments made by Tenants : The incidence of compensation to be paid to intermediaries has ultimately to fall on the tenants and sub-tenants. The State recovers rent from the tenants and pays compensation to the owners out of its increased revenues. Every effort has, however, been made to ensure that the total annual burden on cultivators to whom the lands are allotted does not exceed the fair level of rent. The object is to improve the status of the tenant by the purchase of superior proprietory or quasi-proprietory rights. The amount may be paid in lump sum or equated annual instalments. Since the amount of compensation to be paid to intermediaries is at much lower rates than the market price of land, it has been a gain for the tenants.

Not all the landlords in the country are descendants of former revenue farmers. A number of them actually purchased land and invested on its improvement. They belong to the genuine class of landlords as anywhere else in the world. But in the payment of compensation to them, under the various Zamindari Abolition Acts, it was not administratively feasible to make any distinction between those who acquired the title of landlords without any investment and those who invested on it their hard-earned wealth.

The outgoing intermediaries and the old classes of tenants under the terms of settlement would pay to the State the existing rates of rents or such fair and equitable rents fixed by the State Governments. In Assam and Tamil Nadu, fresh settlements on ryotwari basis would be introduced in areas taken over by the State, but, pending such settlements, rates of land revenue would be determined on the basis of existing rents or rates chargeable on similar lands. Under the Assam Act during the transitional period, the land revenue realizable would not exceed the rent which was payable by the ryot to the proprietor or the superior tenure holder immediately before the date of notification.

In Tamil Nadu, the land revenue would be equal to the rent which would have been payable to the landholder during *fasli* year in which the Act was notified.

All *Bhumidars* and *Sirdars* in Uttar Pradesh are jointly responsible to the State Government for the payment of land revenue. In the case of *Bhumidars* and *Sirdars*, land revenue is equal to the revenue of rent payable by them before the date of vesting. When *Sirdars* acquire *Bhumidars* rights on payment of the prescribed amount, they get a reduction of 50 per cent in the land revenue payable by them on the date of admission. The land revenue payable by *Bhumidars* would not generally be revised for 40 years after the commencement of the Act except on ground of increase or decrease in the area of their holdings.

Those who wish to purchase the ownership rights immediately have to pay a multiple of their annual rent. In Uttar Pradesh this is ten times and three or four times the present rent for absolute occupancy tenants and occupancy tenants respectively and six and fifteen times for occupancy tenants and sub-tenants respectively in the Madhya Bharat region of Madhya Pradesh.

The time lag between the enactments relating to abolition of intermediary rights and their implementation was used by a number of zamindars to evict the tenants so as to enlarge the size of *sir* and *khudkasht* holdings and have it classified in the village records as 'under personal cultivation'.

The so-called 'voluntary surrenders' reported on a large scale from various States, were actually 'forced evictions'. To curb this tendency, special acts and orders have been promulgated in States like Assam, Bihar, Tamil Nadu, Karnataka, Rajasthan and Delhi. These acts seek to protect the interests of tenants, check their eviction, and prohibit land transfers pending introduction of reforms. Some of these also contain provisions for the protection of trees, private forests, irrigation works, etc.

Suggestions have also been made that even where a surrender is registered, the landlord should be entitled to take possession of the land only to the extent of his right to resumption, the balance being taken over by the State. A few States have made provision for the review of voluntary surrenders. All these laws, however, seem to have failed to remove the harm already done.

Efforts have also been made by landlords at some places to circumvent the legislation by entering into mutual agreements with the tenants. The landlord pays full or part of the compensation to be paid by the tenant and takes possession of a portion of the land which would otherwise have remained with the tenant. In States like the former PEPSU State such an arrangement was declared as legally valid.

In spite of these evasions, the share of cultivated land directly settled with Government has increased considerably. Vast areas of waste-land and grazing grounds which belonged to the zamindars now belong to the village communities.

Tenancy Reforms : The intermediary abolition acts did not affect the tenants-at-will and other layers of non-occupancy tenants, ryots, under-ryots, share-croppers, etc. The object of tenancy legislation in India is to help this class of cultivators in the States where intermedairy abolition acts have been passed and to define the tenure arrangements to ensure more productive use of land in the remaining areas where such legislation has not been enacted.

Security of Tenures : Legislation adopted in different States for tenancy reforms follows two broad patterns. Comprehensive legislation has been adopted in Assam, Maharashtra, Tamil Nadu, Jammu and Kashmir, Punjab, Rajasthan, Uttar Pradesh, West Bengal, the former State of Hyderabad, and the centrally administered Union Territory of Delhi, defining the tenure arrangements on the basis of the new social policy.

In Andhra Pradesh, parts of Kerala, Tamil Nadu, Karnataka, Orissa, and Bihar legislative action in this direction is only of a stop gap nature providing for stay of ejection and regulation of rent. More comprehensive legislation is in different stages of formulation in these States. The Madhya Pradesh Government has yet to initiate legislation for stay of ejection of tenants in what was formerly known as the Central Provinces. Provision has, however, been made for conferment of occupancy rights in lands which have been let out for three years or more in any consecutive period of five years.

Resumption of Land for Personal Cultivation : Experience has shown that land owners are liable to misuse the saving clause 'personal cultivation' and eject tenants. In order to ensure that only *bonafide* cultivators resume lands from tenants, the Second Plan imposed certain obligations on the owners and defined 'personal cultivation' to include: (1) personal supervision by the owner himself or by a member of the owner's family and in order that personal supervision may be effective, the owner or a member of his family must reside in the village in which the land is situated or in a nearby village within a distance to be prescribed; (2) the owner must bear the entire risk of cultivation; and (3) the owner or a member of his family should contribute personal labour to cultivate the land.

Tenancy legislation, practically in all the States, contains some of these clauses to define 'personal cultivation' but in none of the legislation area all the three clauses referred to above are enacted. The first and the second clauses have, for example, been enforced in Maharashtra, Rajasthan, and a number of other States. Assam, on the other hand, has introduced only the first one.

Certain safeguards have been provided for persons serving with the armed forces, unmarried women, widows, minors, and other persons suffering from mental or physical infirmities. Such persons enjoy the right to lease out land and to resume for personal cultivation when the disability ceases.

Some recommendations have also been made in the Second Plan about the area which the tenant can retain. It has to be equitably determined and demarcated by the authority and permanent and hereditary rights conferred on tenants in respect of non-resumable areas. In short, the interests of owners who wish to cultivate per-

sonally and of a tenant who may be deprived of his living on account of resumption, have to be reconciled.

Legislation adopted in various States, for the purpose, may be grouped under five heads. (1) In some areas such as Uttar Pradesh and Delhi, the landlord is not allowed to resume any land by ejecting tenants; and tenants holding land on a particular date are conferred permanent and heritable rights.

(2) In Maharashtra, Punjab, Rajasthan, and Himachal Pradesh, a tenant has the right to retain a minimum area or he gets an alternative area before he is ejected. In either of these cases, an upper limit on the resumption of land by the land holders is fixed. The upper limit varies from State to State.

(3) Though an upper limit on the resumable area is imposed there is no provision for the tenants to retain or obtain a minimum holding. Assam, Madhya Pradesh (Berar area), former Hyderabad area, Orissa, former PEPSU, Kutch, West Bengal and Jammu and Kashmir are in this group.

(4) Measures in the form of an order for staying ejection have been adopted in certain areas to give temporary protection to the tenants. These areas are Andhra Pradesh, Vidarbha area of Maharashtra, Kerala, Madhya Bharat, Bhopal and Vindhya Pradesh areas in Madhya Pradesh, Tamil Nadu, Karnataka, Orissa and Manipur.

(5) Finally, States where no upper limit for resumable area exists and the landlord has the right to eject the tenants at will. In other words, he can resume the entire area for personal cultivation. Here there is generally no security of tenure.

Regulation of Rent : The First Five Year Plan recommended that the maximum rent should not exceed one-fourth or one-fifth of the gross produce. Legislation for the regulation of rent has been adopted or is under progress in all the States. But there is great variation in the rates of rents fixed in the States. For example, in Maharashtra and Rajasthan, it is one-sixth of the gross produce. In Assam, parts of Karnataka, Orissa, Delhi and Himachal Pradesh, rents have been fixed at one-fourth or even less. In Jammu and Kashmir, Karnataka, Bihar and Punjab rents have been fixed at one-third of the gross produce. In a few States, rents have also been fixed as a multiple of land revenue.

Existing rates in some States, like Bihar, Jammu and Kashmir, Tamil Nadu, Karnataka, and Punjab, still exceed the prescribed limit under the First Plan. Steps are being taken to reduce them. In Madhya Pradesh and Saurashtra regulation of rents has yet to be taken up. The Report on the working of Bombay Tenancy Act, 1948, observes that share rents have remained unchanged whereas cash rents have shown no signs of reduction. On the contrary, it is found that on occasions when tenants were changed, there

have been more cases of enhancement than of reduction in the rent. In Gujarat, it is found that except for Broach, the level of rent was in excess of the legal ceiling. In this connection the Report says : "The socio-economic factors and traditions were powerful forces in determining the levels of rent and it will take time to overcome them to adjust the levels of rent to the statutory level of ceilings. In spite of the fact that maximum rents have been fixed in most of the States, the tenants' position remains more or less the same. It may be difficult to draw a general conclusion for the country as a whole, based on the experience of a single State, but all the same, this provides some indication of the situation prevailing in the country".

Ownership Rights for Tenants : Some sort of protection has been given to the occupancy tenants. But tenants-at-will had not been protected so far and they had no permanent rights in land. Recent enactment entitled both these types of tenants to acquire ownership of land under certain conditions.

The objective of bringing together in one person, the right to own and the right to use in respect of non-resumable area was thus proposed to be achieved. As stated in the First Plan, the present link between the tenants and rent receiving owners has to be removed and tenants brought into direct relationship with the State.

Various enactments in different States have made provisions to effect this change. The basis for determining the price of land which tenants wish to purchase and its mode of payment differ from State to State. Care has, however, been taken to ensure that the aggregate of the amount of payments of compensation does not exceed the level of rent recommended in the Plan.

Action taken by various States for transfer of ownership to tenants follows broadly the following pattern :

(1) All tenants have been brought into direct relationship with the State, as in Uttar Pradesh. The State recovers rent from the tenants and pays compensation to the owners out of its increased revenues. In Delhi, the tenants get full ownership rights and are required to pay compensation direct to owners in addition to payment of revenue to the Government.

(2) Tenants have been asked to buy ownership rights by a stipulated date, failing which they become liable to ejectment. The Bombay Legislation contains a provision along these lines.

(3) Tenants have been given optional right of purchase on payment of price, regulated by law and payable in instalments spread over a period. In States where legislation has been enacted for converting tenants into owners, about 34.39 lakh tenants and share croppers have acquired ownership of more than 31 lakh hectares.

Redistribution of Land : A major decision has been taken in favour of redistribution of land to fulfil the objectives of reduction of inequalities and more even distribution of economic power in a democratic-socialistic State. The following measures relate to redistribution of land to help landholders with uneconomic size holdings and landless persons :

(i) Ceiling on Holdings
(ii) Settlement Projects
(iii) Bhoodan Movement

Ceiling on Holdings : A ceiling on the size of holdings means a statutory absolute limit on the total area of agricultural land that an individual may possess (in one or a number of units). It was proposed in the First Five Year Plan that a limit on the extent of land, an individual or a family should be allowed to hold, be imposed in all the States. In order to implement this suggetion, a census of land holdings and cultivation was undertaken. The Committee of the Panel on Land Reforms also recommended ceilings on the aggregate area held by a family. Land held in excess of that limit, it was proposed, shall be distributed among landless agricultural persons and those with uneconomic holdings. Various plans have reiterated the importance of implementing this decision at an early date and the Nagpur Resolution of the All India Congress Committee in January 1959, stated that legislation to this effect should be completed by the end of 1959.

Objectives : Ceilings on land can have broadly two objectives, *viz.*, (1) social justice to level down the difference between the 'haves' and the 'have-nots', by reducing glaring inequalities in ownership and use of land as well as in agricultural incomes, and (2) increased production in the interest of the country as well as the individual by meeting the widespread desire to possess land and enlarging the sphere of self-employment.

It has thus been suggested that steps be taken to diffuse ownership to reduce tension in the country and provide an incentive for increased output. The Mysore Tenancy Agricultural Land Law Committee has gone further and suggests that ceilings may also be imposed in other sectors of the economy so that there may be no sense of grievance on the part of agriculturists.

Ceilings have thus to be viewed, not as an isolated measure, but as an essential part of a fully considered scheme of reorganization of the agricultural economy.

One of its primary objects is that land should be cultivated only by those who have complete interest in it. Fixation of ceilings would

remove all disinterested parties from the land. Surplus land, thus made available, can then be distributed among the landless. Past experience has been that generally, the large land holders did not pay proper attention to the cultivation of the entire land held by them nor did they make any investment on improvement of the land. Still they preferred to maintain their hold on the land. With their elimination, all classes remaining on land will cultivate their entire holding efficiently.

Legislation on Ceiling : Legislation on ceilings has been enacted in most of the States (Table XIII). It imposes either a limit on future acquisition, *i.e.* no one can increase the area held by him beyond the limit imposed by the ceiling fixed for the region, or a limit on the size of existing holdings, *i.e.* the land in excess of the ceiling will be acquired by the State.

TABLE XIII

Land Ceiling in States

States	Future Acquisition	Existing Holdings
Andhra	11.5 to 106 Hectacres	110 to 132 Hectacres
Assam	20.4 „	20.4 „
Bihar	8 to 24.5 „	8 to 24.5 „
Gujarat	7.7 to 53.5 „	7.7 to 53.5 „
Jammu and Kashmir	9.7 „	9.7 „
Kerala	6.1 to 15.3 „	6.1 to 15.3 „
Madhya Pradesh	10.2 to 30.5 „	10.2 to 30.5 „
Tamil Nadu	9.7 to 40.7 „	9.7 to 40.7 „
Maharashtra	4.9 to 34.2 „	7.3 to 51.3 „
Karnataka	7.3 to 58.6 „	11.0 to 87.9 „
Orissa	8 to 32.6 „	8 to 32.6 „
Punjab	12.2 Standard „	12.2 Standard „
Rajasthan	12.2 Standard „	12.2 Standard „
Uttar Pradesh	5.1 „	5.1 „
West Bengal	10.2 „	10.2 „
Manipur	10.2 „	10.2 „
Tripura	10.2 to 30.5 „	10.2 to 30.5 „
Himachal Pradesh	12.2 „	12.2 „

Bhoodan Movement : It is a non-official movement under the leadership of Acharya Vinoba Bhave. The movement for voluntary land gift has the sympathy and support of the Congress, the present ruling party. Describing the aims of the movement, Acharya Bhave, said : "In a just and equitable order of society, land must belong to all. That is why we do not beg for gifts but demand a share to which the poor are rightly entitled. The main objective is to propagate the right thought by which social economic maladjustment can be corrected without serious conflicts."

In its practical application, *Bhoodan* takes the shape of asking for voluntary donations of one-sixth of the land from owners for redistribution among the landless. In the non-agricultural sector, the movement assumes various forms such as *Sampattidan* (donation of money or other resources), *Budāhidan* donation (donation of mental abilities) and *Jivandan* (donation of life).

Progress under Bhoodan: The movement which began on a modest scale on April 18, 1951, now covers the length and breadth of the country. The initial target was to obtain 20 million hectares of land so that it may be possible to provide some land for cultivation to every rural family. Total collections so far have been only 1.7 million hectares under the movement. Of this, only ·5 million hectares have been distributed among the landless. There are quite a number of snags in redistributing the land so collected. In a number of cases, the Government did not have proper land records and about 40 to 50 per cent of the land collected was fallow. The progress of the movement is actually very slow for the last few years when hardly any new land has been collected.

In 1965, Vinobaji launched a programme *Toofan Gram Dan*, a whirl-wind campaign to collect gifts of whole villages in Bihar. The ideal was that all land should belong to the village community as a whole. Following this call, as many as 41 thousand *Gram Dan* have been made in Bihar, a State which was fast heading towards the achievement of a complete 'State *Dan*'. Bihar, Tamil Nadu, Orissa, Madhya Pradesh, Uttar Pradesh, Maharashtra and Rajasthan Governments had already pledged full co-operation to *Sarvodaya* workers in bringing these States within the purview of the *Gram Dan* Movement during the Gandhi Centenary Year.

As in the case of land donated under *Bhoodan*, the land received in over 1 lakh *Gram Dans* has also to be legally transferred in the name of the *Gram Sabhas*. *Sarvodaya* workers have not yet concentrated on the functioning of the *Gram Sabhas*, but they were only trying to collect as many *Gram Dans* as possible.

The implementation of the whole *Sarvodaya* programme would be carried through *Gram Dan Sabhas* after they have achieved a few *State Dans*.

The *Gram Dan* Movement aims at achieving a total rural revolution through peaceful means. It was also an educative process to educate the rural people about the value of collective ownership and forewarning them against the vested interests of landlords and unusers. In that sense, it was a silent revolution which was bound to have social and political repercussions in the near future. There was urgent need for evolving a way for a village oriented economy. The present official plan and policy of development were business

oriented. *Gram Swaraj* would completely reverse this process and the *Gram Sabhas* would work for an agro-industrial self-reliant economy which would progressively eliminate exploitation of the masses and disparity in incomes. The village oriented economy would be an economy of sharing, as distinguished from the economy of a competitive market. This calls for decentralization of power giving villages some autonomy.

It is very difficult to say at this stage how far these ideals will be achieved. Although much of the land that has been donated is reported to be unfit for cultivation, the area of land made available through *Bhoodan* is no way insignificant as compared with the land to be acquired through legislation on ceilings. A more significant point to be stressed is that such a large area of land has been given as a free gift even when the position with respect to the availability of land is not at all comfortable and the majority of Indian farmers are themselves small holders. Judged in this way, it is certainly a great success. Even the worst critics of the movement have no hesitation in agreeing that the achievement has no parallel in the world.

Land Management Legislation : The First Five Year Plan recommended that individual owners should conform to standards of efficiency determined by law in the cultivation and management of land. In their application, these standards were thought of, in the first instance, in relation to large holdings. In the Second Plan it was suggested that standards of efficiency and management would apply to all holdings.

The Committee of the Panel on Land Reforms recommended that all farmers should be obliged to maintain reasonable standards of production and preserve and develop the fertility of the soil. There should be land management legislation to provide necessary incentives and sanctions for the performance of this obligation. Implementation of the legislation at the village level should be undertaken generally through village panchayats, but suitable arrangements for supervision would be necessary.

The purpose of land management legislation as envisaged by the Panel on Land Reforms may be classified broadly as follows :

(1) To provide for cultivation of all land suitable for cultivation.
(2) To ensure proper standards of cultivation.
(3) To ensure collective or group adoption of certain practices.
(4) To enforce changes in cropping pattern and introduce new combinations of enterprises, *e.g.* mixed farming.
(5) To participate in co-operative societies.
(6) To provide incentives.
(7) To take punitive action.

The main purpose of the management legislation by itself is to instil a sort of fear of punitive action in the minds of farmers in case they failed to adopt improved management practices.

Because of difficulties in determining the output, the norms suggested relate to the adoption of improved practices. In some States, powers have been acquired under which the authorities can ask the owners of waste and fallow land to bring them under cultivation. In case of default, the Government would lease them out to tenants for a number of years. Assam and Madhya Pradesh have increased assessment on waste lands so as to induce the owners to put such land under the plough. Again, management of estates in certain cases can be taken over by the Government. In Maharashtra, if land is not properly cultivated or is lying uncultivated for any two seasons, whatever the reasons, the Government can assume management immediately. Government may also take over land when it considers necessary for the purpose of improving the economic and social condition of peasants.

Recent Changes : Many State Governments have recently been trying to reduce the ceiling on holdings. Tamil Nadu announced a reduction of ceiling of land holdings from 12.14 to 6.07 standard hectares. This was resisted by land owners in Thanjavur district. After the first Land Ceiling Act was enacted in 1961, only 26.30 thousand hectares out of 103.60 thousand hectares said to be surplus were notified ; of this only 3.2 thousand hectares were assigned to tenants. If the ceiling is reduced to 4.05 hectares as proposed a further surplus of 81, thousand hectares will be made available. If implemented, this will deprive 45 thousand land owners of their land to benefit only 40 thousand at the rate of 2.02 hectares each.

Besides Tamil Nadu, the ceiling, at present varies from the absolute area limit of 6.07 to 15.17 hectares in Kerala, 12.14 standard hectares in Rajasthan and Punjab, 10.92 to 131.12 hectares in Andhra Pradesh and 16.19 hectares in Uttar Pradesh. The Central Land Reforms Committee which had long been examining this question recommended a ceiling of 4.05 to 7.29 hectares with assured irrigation and 4.05 to 21.85 hectares of unirrigated land for a family of five.

Generally, the level of ceiling is the lowest for land with assured irrigation and highest for dry farming. In Tamil Nadu, the level depends upon the rate assessment while in Haryana and Punjab the criterion adopted is the gross yield. In Uttar Pradesh, the ceiling is based on the hereditary rent rates prescribed at the time of settlement of resettlement. The case has been made out with the application of a ceiling on family basis to provide an effective check against clandestine transfer of land to members of the family with a

view to evading the ceiling laws. The ceiling is, therefore, to apply to the aggregate area held by all members of a family and the family is defined as one which includes the husband, wife, their children and grand-children.

The Central Land Reforms Committee will also consider the suggestion that transfers made after the prescribed date of any new ceiling laws should be void or be disregarded in order to prevent *benami* transfers. The States have their own laws on land transfer which give enough opportunities to the holders for manipulation within the laws. Most of the States have exempted land used for cash crops from the existing ceiling with the result that a large number of landlords have switched over to this type of crop. There is no ceiling in Madhya Pradesh on mechanized farming, while in Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Karnataka, Orissa, Uttar Pradesh and Punjab sugarcane farms operated by sugar factories are exempted from ceiling.

The Committee will, therefore, discuss the application of uniform ceiling laws for lands growing cash crops or mechanized farms. Land held by religious, charitable and educational trusts will also come under review.

In Andhra Pradesh, so far, 567 hectares of land have been taken over but not distributed. Assam has acquired nearly 30,000 hectares of surplus land but has not so far framed rules to implement the reduced ceiling level. In Bihar, no land has been declared surplus. Haryana has distributed only 22,000 hectares of the 70,000 hectares declared surplus while in Maharashtra 25,032 hectares of land out of 117,437 hectares declared surplus have been distributed. There have been reports of large-scale manipulation from Maharashtra.

There are similar reports from other States of non-distribution of land. The Committee is likely to go deeper into the causes which have prevented these States in implementing ceiling laws or delaying the distribution of surplus land.

Implementation of the recommendations of the Central Land Reforms Committee is likely to meet with resistance from many areas where pressure groups have grown.

The inadequate implementation of the agrarian reforms came under criticism recently. The Conference of Chief Ministers on Land Reforms in 1970 came to the conclusion that the biggest problems in implementing the land reforms measures were sub-tenancies, land records, level of ceiling on land holdings, payment of compensation to landlords and intermediaries, landless agricultural labourers, provisions of the Constitution of India and recourse by landlords to courts

of law. After detailed discussions, the following decisions were taken :

1. Abolition of all intermediaries to be completed by December 1970, in all the States.
2. State Governments to expedite the completion of making up-to-date record of rights.
3. To enact legislative provisions to make resumption of land by landlords difficult.
4. To expedite the implementation of the programme of consolidation of holdings.
5. To set up a committee at the Centre with the Agriculture Minister as chairman to watch the progress in the implementation of land reforms.
6. To set up similar State committees under the chairmanship of the Chief Ministers.
7. Common services like making available tractors to the community, should be provided for a block of say 80.94 hectares allocated to landless labourers.

Review of Progress : A review of the progress of land reforms reveals that progress is neither uniform nor complete in the States.

For instance, legislation enacted for the abolition of *inams* in Andhra Pradesh is yet to be implemented in the Telengana area. The *muttadhari* tenure is still to be done away with by law. Land declared surplus so far has not been taken possession of by the State for distribution. Similarly, in Bihar the sharecroppers (*bataidars*) who hold land or oral lease and are generally not recorded, do not enjoy security of tenure. No surplus land has been taken possession of for distribution. In Tamil Nadu, tenants of landowners holding more than 5.39 hectares of wet land or its equivalent have been given protection but other tenants are liable to eviction from half of their holdings on grounds of resumption by landowners for self cultivation. Comprehensive tenancy legislation is yet to be enacted. In Karnataka, provision has been made for bringing tenants of non-resumable land into direct relationship with the State; but this provision is yet to be enforced. Also pending enforcement is a provision fixing ceiling of 10.92 to 87.42 hectares on existing holdings and of 7.29 to 58.28 hectares on future acquisitions, depending on the class of land. In Orissa, the provision for ceiling on land holding at 8.09 to 32.37 hectares has not been enforced, so far. In Punjab, there is no ceiling on ownership. The Government has, however, been empowered to settle tenants on land cultivated by a person in excess of the permissible limit.

The landlord's right of resumption in Punjab and Haryana is

subject to the condition that the tenant is given alternative land upto the prescribed limit for cultivation. In other States, the tenants and sharecroppers have only interim protection.

Legislation for seeurity of tenure has been passed in most of the States. While in some States like Uttar Pradesh, no resumption was permitted to landlords and tenants have substantial rights in respect of their entire holding, in other States, such as Gujarat, Orissa, Maharashtra, Kerala, Madhya Pradesh, Rajasthan and Manipur and Tripura, landlords were permitted to resume land for personal cultivation within a specified period in certain cases; in respect of the remaining area, the tenants got substantial rights. In Rajasthan, steps are yet to be taken for acquisition of surplus land. Ceiling on land holdings varies from 8.9 to 135.98 hectares. In West Bengal, a landowner may resume the entire area leased to a sharecropper if he owns less than 3.03 hectares and two-thirds of the area in other cases. Pending finalization of comprehensive proposals with regard to *bagadar*, eviction proceedings have been stayed.

The Central Land Reforms Committee is again seized of this question and has been examining the various aspects for quite some time. Although the land grab movement organized by the left parties during 1970 failed, it highlighted the fact that the wave of unrest is bound to rise. This is the view expressed in the World Bank's Annual Report on the Indian Economy placed before the Aid Club Meeting in Paris during June 1970. According to the Bank Report, first priority should be for a tenancy reform programme, centred on rent ceilings and security of tenure. It also urges enhancement of land revenue, and the taxation of larger incomes from farming at par with incomes derived from other sources.

Taking note of the long-term implications of farm mechanization, the report argues that items like tractors and harvesters should bear a higher tax, not only to augment the Government's revenue but also to make the mechnization process "bear some of its real economic costs."

VII. Unit of Cultivation

India is a country of small farmers, but not necessarily of small farms. This apparently paradoxical statement may be explained by the fact that 81.65 per cent of operational holdings are below 4.05 hectares, as much as 60.63 per cent of the land is cultivated in units of more than 4.05 hectares each.

The all-India average size of agricultural operational holding is 2.65 hectares. The average for different States varies considerably. Thus, at one end, Kerala has an average of 0.7 hectares and at the other Rajasthan has the highest average of

5.58 hectares. As a result of the growth in population and also of the land reform measures adopted since independence, several significant changes have taken place in the agrarian structure. The average size of agricultural operational holding has declined from 3.05 hectares in 1953-54 to 2.65 hectares in 1959-60. The 1961 Population Census records 2.99 hectares as the all-India average size of holding. The number of holdings below 2.02 hectares and the aggregate area comprised by them have increased during the period, the latter increasing at a relatively higher rate. At the other end, holdings of 20.23 hectares and above have declined in number and the area occupied by them has come down by as much as 30 per cent.

Nearly one-fifth of the holdings are below 0.46 hectares. But cumulatively they occupy only 1.59 per cent of the total cultivated area. At the other extreme, a little over one per cent of total operational holdings are of the size-group of 20 hectares and above, but they occupy as much as 12.13 per cent of the total area. It should, however, be noted that the size-groups of the holdings do not necessarily indicate their economic worth. The average size of holdings is generally small in areas where the yielding capacity of land is more because of assured rainfall, irrigation facilities, better quality of soil, etc. Holdings in such areas tend to get divided because a hectare of land with a relatively high yielding capacity is able to sustain more persons than an area whose yielding capacity is low. It has been shown that an inverse relationship exists between the yield per hectare and the average size of holding.

The numerical preponderance of small farms is thus essentially a consequence of excessive pressure of population on land and underdevelopment of economy, rather than an excessive concentration of ownership.

A holding in agricultural parlance means the total area under ownership or operation of a farmer. A holding, however, rarely consists of a single compact farm. Usually, it comprises of several plots or fragments as they are called in India. The extent of fragmentation by size-groups of holdings is given below :

TABLE XIV

Estimated Number of Fragments per Operational Holding and Average Area on Each Fragment

Size-group (hectares)	*No. of fragments per holding*	*Average area of fragments (hectares)*
Upto 0·20	1.61	0.06
0.20—0.40	2.82	0.10
0.40—1.01	4.41	0.15
1.01—2.02	6.30	0.23

Legislative measure for consolidation of fragments have been enacted in all States (Table XV). Consolidation of holdings has been completed in Punjab and Haryana. The work has been largely completed in 45 out of 54 districts in Uttar Pradesh.

TABLE XV

Progress of Consolidation of Holdings

Area ('000 hectares)

State	*Level achieved cumulative*			*Fourth Plan programme*	*Level anticipated 1973-74*	*Fourth Plan outlay (Rs. lakhs)*
	1960-61	*1965-66*	*1969-70*			
Andhra Pradesh	127	337	339	—	337	—
Assam	—	2	2	41	43	9.75
Bihar	24	71	85	165	236	25.00
Gujarat*	375	652	1,011	410	1,258	61.80
Haryana	—	—	3,273	3,273	121	**
Jammu and Kashmir	—	22	25	41	65	30.50
Madhya Pradesh	1,560	2,378	2,915	1,230	4,249	100.00
Maharashtra*	626	2,202	5,347	3,345	7,077	125.00
Karnataka	406	772	807	n.a.	1,322	55.00
Punjab	6,011	9,203	3,940	3,940	9,203	**
Rajashan	571	1,722	1,752	—	1,744	—
Uttar Pradesh	2,201	6,482	9,480	3,400	12,281	2,260.00
West Bengal	—	—	—	710	710	82.25
Delhi*	83	83	68	—	83	—
Himachal Pradesh	66	149	155	82	267	86.50
Total	12,050	24,075	29,199	16,637	38,996	2,835.80

*Includes progress prior to April 1951

**Work completed

Consolidation of fragments, however, does not solve the problem of small holdings. It makes the operation of the existing holdings more economic. The problem of small holdings can be tackled at two different ends. First, further division of small holdings can be prohibited. Legislation for this has been enacted in several States, but for a variety of reasons—mainly the inheritance laws and lack of alternative occupations for descendants who are denied the share—implementation of the legislation is not effective. At the other end, small holdings may be pooled for the purpose of joint cultivation. This system has certain distinct advantages ; economy in the use of bullock power, improved credit-worthiness, capital formation through joint labour, etc. It, however, does not alter the adverse man-land ratio. With the increase in the size of cultivation unit, there would be economy in the use of labour and disguised unemployment will become open and apparent. In spite of repeated policy decisions to encourage co-operative joint farming, efforts in the direction have not yet yielded demonstrable results.

As on 30, June 1969, there were nearly 8,165 co-operative farming societies with a membership of 2.2 lakhs and covering an area of 4.18 lakh hectares. Of these, the number of joint farming societies was 5,300 with a membership of 1.2 lakhs and covering an area of 2.54 lakh hectares. The task is admittedly very difficult coming up as it does against strongly rooted social and psychological attitudes. In the ultimate analysis, the problem of small holdings will not be solved and may become even more acute—until a large percentage of rural population can be provided with non-farming occupations. This is the major task of economic development.

Legislation on Consolidation of Holdings : The legislation on consolidation of holdings in India has passed through three stages since its inception. In the first stage, it was wholly permissive and was aimed at facilitating transfers and exchanges mainly through the offer of some concessions and with the help of trained staff. The initiative to consolidate the small and scattered holdings was left to farmers themselves. Co-operative societies were encouraged to take up consolidation work with the help of the staff under the Co-operative Department on voluntary basis. As no commendable progress was made through these legislations, an element of compulsion had to be introduced in the second stage. The Central Provinces Consolidation of Holdings Act, 1928, for example, authorized the consolidation officers to confirm and implement a scheme of redistribution of holdings, when not less than one-half of the permanent land holders holding not less than two-thirds of the occupied areas, agreed to it. Such a scheme would then become compulsory and binding on all the permanent right holders in the

village. Similarly, if two-thirds of the tenure holders in a village apply for consolidation the application would be considered as one made on behalf of all the tenure holders in the village. The Uttar Pradesh Consolidation of Holdings Act, 1953, provided for compulsory consolidation at the initiative of the State.

The enactment of the Bombay Prevention of Fragmentation and Consolidation of Holdings Act, 1947, marked the beginning of the third stage in the consolidation legislation in the country. This Act provides for a greater element of compulsion in the enforcement of a scheme of consolidation in any given area regardless of the willingness or otherwise of the land holders of the locality. But at each stage of the consolidation programme, objections from the people affected are given due consideration by the Consolidation Officer. Though the timings of the three stages were different in various States, at present compulsory consolidation is accepted as the common policy objective in most of the States.

The broad frame-work of the consolidation programme has been the same for all the States, but within it there are many minor differences in the methods and the procedures and the administrative set up as well as in regard to recovery of the cost of consolidation. A noteworthy feature of consolidation programme of Punjab is that the object of consolidation in this State is not merely to consolidate small and scattered holdings into compact blocks, but also of replanning into compact blocks. It seeks to co-ordinate all-round developmental activities in the villages reserving sites for schools, playground, *Panchayat Ghar*, etc. Circular roads skirting the village and roads linking different villages are also laid. Thus it may be said that in Punjab consolidation truly forms part of a comprehensive plan of rational lay out of land surface. In Maharashtra, part of former Bombay State, incentives are provided in the form of various concessions to agriculturists whose lands are consolidated to enlist their participation. To enable the poor agriculturists to pay compensation that may become due from them on account of consolidation work, *taccavi* loans are advanced.

In order to encourage the States to expand their programmes for consolidation to the maximum scale administratively feasible, the Ministry of Agriculture provides assistance for consolidation work as part of the Grow More Food Programme. This amounts to 50 per cent of the net expenses incurred by the State Government, subject to an overall maximum of 25 per cent of gross expenditure on consolidation.

However, the programmes of consolidation work could not be extended to the entire area in all the States due chiefly to the inadequacy of the administrative machinery. It was, therefore, thought

advisable to give priority to those areas which have irrigational facilities, adequate rainfall or the areas which are likely to come under irrigation works. This shift in policy, though encourged and expedited consolidation work in the selected areas, has not been successful in accelerating the consolidation programmes as a whole.

Consolidation Problems and Prospects : During the operation of the consolidation programme during the last decades, several problems of practical importance have been noticed. These relate to the land records and administrative procedures. Preparing proper revenue records for the whole country is a stupendous task. But its absence has delayed the consolidation programmes to such an extent that as many as 10 to 15 years were taken to finish the consolidation work in some villages. Special legislative measures have been taken to expedite completion of land records.

The sentimental attachment of the cultivators to their ancestral land has rendered the exchange of land very difficult in many cases. There is also the psychological tendency of assessing the value of one's own land at a higher rate than that of others.

Recent thinking in the Planning Commission is that consolidation of holdings must be made compulsory under law. Prior to consolidation, the entire land in each village should be topographically surveyed and levelled to receive water wherever it is available, and irrigation channels and drains constructed for the entire village. If there is potential for additional minor irrigation (ground or surface) works these should be constructed, and in dry villages without any potential for water distribution, land levelling and counter bunding for soil and moisture conservation be effected. The laying of feeder roads will also be tried to the land development programme. The developed land should be so distributed among the owners that each one of them has his holdings in one or at the most two pieces.

The maintenance and operation of the works constructed as part of the integrated programme may be the joint responsibility of the State and the panchayats. Compulsory consolidation works must have affected million hectares of land which are envisaged to receive new irrigation benefits from the major, medium and minor irrigation schemes provided for in the Fourth Plan.

The expenditure involved in integrated programme covering 8-10 million hectares will be about Rs. 200 crores over a five year period and most of the resources for the purpose can be raised by diverting part of the allocations for agriculture, irrigation, flood control and rural electrification already made in the Plan.

VIII. Agricultural Practices and Techniques

Transforming traditional agriculture into a progressive one through improvements in cultivation practices and techniques is a complicated process; results are slow and imperceptible. After World War II, a beginning was made under the Grow More Food Campaign to attempt a breakthrough. These efforts were stimulated further under the Five Year Plans through the Agricultural Extension Service and Community Development Projects. By 1963, almost the entire country was covered by extension agencies and their efforts were aided by programmes in other fields such as irrigation and production of fertilizers and farm implements. The latest is the introduction in 1967-68 of High Yielding Varieties Programme (HYVP) under the New Technology. These efforts, by and large, have yielded encouraging results; the use of improved seeds, fertilizers, pesticides and improved implements has spread and the willingness of farmers to accept new techniques has increased. However, the breakthrough is far from complete; substantial ground remains to be covered in several directions. But for wheat, yields in respect of other cereals and non-cereals have virtually remained stagnant for some time past. On the whole, traditional techniques still hold sway.

Traditional techniques are evolved over generations, they are continuously adjusted within a rather restricted frame to changing circumstances. As such, the farmers generally acquire a high degree of competence in the use of these techniques. The pursuit of traditional techniques involves less uncertainty. Since traditional techniques are passed on from one generation to the other, there is practically no material cost involved in acquiring them. Low cost and relatively less uncertainty of output are the two major reasons for the reluctance of the farming community to change over to the new and modern techniques.

Traditional techniques are evolved around efficient land use under meagre supply of capital. Low cost, self-reliance for supply and maintenance of production assets and intensive use of labour are the major characteristics of the traditional system of cultivation in India as elsewhere in most under-developed countries. Under these conditions, the implements used are simple in design. There are variations in design, adjusted in most cases to local conditions, to soil requirements and weather and to types of crops grown. In a vast country like India, therefore, there is a wide variety of implements. Seed and manure resources are largely locally developed and cultivation practices are adjusted to individual crops.

Crop rotation, double cropping, mixed cropping, preparation of seed-beds, and practices regarding sowing, inter-culturing and harvesting can be listed under cultivation practices. Even practices regarding watering, fruit culturing, fighting pests and diseases and general care of field and its soil can be included in this category.

Fallowing and Crop Rotation: Both fallowing and crop rotation practices aim at maintaining soil fertility. Continuous cropping drains away soil nutrients; fallowing is evolved to avoid this. Fallowing practices, therefore, vary depending on supply of soil nutrients and the rate of exhaustion of these nutrients by individual crops. In extreme cases of light soil, with scarce supply of soil nutrients, land is fallowed for as many as seven years after each harvest. On the other hand, in fertile soils land is allowed to rest every third, fourth or even a fifth year. As a result of the use of fertilizers and other improved methods of cultivation, area under fallows has been reduced to 20.8 million hectares in 1967-68 from 28.1 million in 1950-51.

The practice of crop rotations is evolved in order to avoid fallowing of land. However, rotation of crops is not a complete substitute for fallowing in all regions. Fallowing is included in the scheme of crop rotation once in three or five years in some cases. Where crops included in rotation supply the nutrients removed from the soil, the need for fallow may be postponed for a long time or where soil nutrients can be supplied from outside in sufficient quantity, fallowing may be completely eliminated. The most common rotations include legumes which help fixation of nitrogen in the soil and they follow such crops as cereals, cotton, etc., which remove nitrogen from the soil. As oil-seeds also help nitrogen fixation, they are rotated with grains. Heavily manured crops like sugar-cane or tobacco are rotated with cereals to take advantages of manurial value in the soil left over from the previous year.

Double Cropping and Mixed Cropping: Where irrigation facilities are available or where rain is heavy enough for adequate soil moisture to be retained till November, double cropping is practised. In regions of perennial water supply, even three crops are taken if resources permit. In double cropping, as in crop rotation, the farmer has an eye also on restoring soil fertility and hence the second crop is often one that fixes nitrogen. Much, however, depends on actual soil conditions. The practices regarding double cropping are, therefore, far too many for selecting typical ones.

Multiple Cropping: With the introduction of short-duration varieties and water management practices, the stage has now been set for a system of multiple cropping. An American variety of short duration cotton developed by the Indian Agricultural Research

Institute, for example, can be grown in rotation with wheat. One of the best Indian varieties of cotton MCU-5 can be grown only in South India. But radiation has helped produce a new mutant strain of MCU-5 which can be grown as successfully in the North as the parental variety in the South. The older varieties of cotton took 6 to 7 months to mature. The new mutant variety which will mature just in 5 months is as good as imported cotton. Similarly, new pulse varieties—*Pusa Ageti, Sharda* and *Mukta* all have a shorter period of maturity, the normal variety of *arhar* takes 10 months to mature while the new ones take just 5 months. The next phase of development is the scientific utilization of available resources in the form of land, water and the freely available modern inputs. As crop rotation is a healthy practice which could enrich the soil and increase the return to the farmer, some enterprising cultivators have been trying multiple cropping methods successfully. These techniques have spread widely among the cultivators in areas where irrigation is from wells or bore-wells.

New varieties of rice, oil-seeds, cotton and pulses have enabled the cultivator in crop planning through the "cafeteria approach". A great many cropping sequences have been evolved from which the farmer can choose according to the marketability of the produce, profitability of the rotation, soil and climatic conditions and his input mobilizing potential. It has been found that by introducing synergystic package comprising new varieties, new agronomic and pest control practices, better nitrogen fixation, the cultivator is able to resort to multiple cropping and at the same time harvest better yields.

There is scope for extending the multiple cropping practices in all areas where farmers have already been attuned to a higher level of agricultural technology through the HYVP. But such an extension without proper preparedness will create problems. However, before introducing the programmes on a large-scale, the Government of India has decided to launch Pilot Programmes of Multiple Cropping in 52 locations (in blocks) in different parts of the country.

These pilot projects will offer technical and financial help to the farmers in the areas covered and at the same time will serve as a sort of field research into the possibilities of growing new crops in different locations. Priorities will be given under the projects to demonstrations of multiple cropping sequences and adaptive research. This field research will ultimately help to perfect the crop patterns and the techniques for raising the crops in the different regions where the pilot programmes are located. Adaptive research and the demonstrations are deemed to be the basic support of the project and hence are fully financed by the Centre.

Livestock Farming : The Multiple Cropping Programme is quite comprehensive and includes livestock farming also where such ventures are likely to be profitable and suited local environments. These pilot projects are likely to offer guidelines for an integrated development of the areas where they are located, based on which the scheme could be implemented on a wide scale. Ultimately it is envisaged that the co-ordinated effort of the Governments, banks, input industries and the farmers will have the way for the multi-faceted development of the rural areas into agro-industrial complexes which could give a good return to the farmers and employment to the local population all round the year.

Mixed Cropping : In mixed cropping, crops are so mixed that soil nutrients removed by some are replaced by others at least partly. Since the growth period of the plants of different crops varies, the practice of a mixed crop enables taking two crops which are sown together but harvested at different times. They are so combined that the total output is larger than what it would be if only one crop was sown. Early maturing crops like *jowar* or *bajri* may be mixed with ground-nut, cotton or pulses, which mature late. When *bajri* is ready for harvest, the shoots of plants of other crops just begin to grow. The different crops grown together have varying susceptibility to variations in weather. Besides, the price-variability of these crops is also different in some cases; crops mixed together are so selected that their prices do not move parallel or the extent of their variations differs. When crops are mixed under the conditions, the farmer is able to reduce the yield and price uncertainties. The proportions of crops mixed varies from region to region and also according to the practice of mixing crops. The important crop mixtures are indicated below :

TABLE XVI

Important Crop Mixtures

State	*Crop Mixtures*
1. Andhra Pradesh	Cotton and corra or ground-nut, cotton and chillies, castor and ground-nut, *jowar* and *moong*, *jowar* and *urad*, *jowar* and *moth*, *tur* and cotton.
2. Assam	Paddy and maize, paddy and cotton,
3. Bihar	Wheat and barley, wheat and gram, gram and barley.

	State	*Crop Mixtures*
4.	Maharashtra	Cotton and *jowar*, *jowar* and *tur*, cotton and *tur*, *bajra* and *tur*, ground-nut and cotton, wheat and gram, ground-nut and *jowar*.
5.	Kerala	Tapioca and beans, *ragi* and legumes, tapioca and coconut, areca-nut and banana, banana and tapioca, coconut and areca-nut.
6.	Madhya Pradesh	Wheat and gram, wheat and linseed, linseed and gram, *tur* and cotton, *jowar* and *tur*, *kondon* and *tur*, wheat, linseed and gram, cotton and *jowar*, cotton and gram, *jowar* and *moong*, *jowar*, *urad* and *moong*, sesamum and *tur*.
7.	Tamil Nadu	Cotton and chillies, ground-nut and red gram, cotton and millets, *cumbu* and black gram, *cholum* and horsegram, ground-nut and *cumbu*.
8.	Karnataka	*Ragi* and *jowar*, *jowar*, castor and *tur*, *tur* and sesamum, *tur* and cotton, *jowar* and *moong*.
9.	Orissa	Horsegram and mustard, green gram and linseed, mustard and linseed, *ragi* and maize.
10.	Punjab	Wheat and gram, barley and gram, wheat and barley, *jowar* and *gaur*, *chari* and *moth*, maize and *senji*, *sarson* and wheat, *toria* and gram, *til* and cotton, *moth* and cotton, bajra and *moong*, barley and *masur*.
11.	Rajasthan	Wheat and gram, wheat and mustard, wheat and barley, barley and gram, *jowar* and *moong*, *bajra* and *moth*.
12.	Uttar Pradesh	Wheat and barley, wheat and gram, barley and gram, *jowar* and *arhar*, cotton and *arhar*, barley and peas.

State	*Crop Mixtures*
13. West Bengal	Wheat and gram, wheat and linseed, paddy and *khesari.*
14. Delhi	Gram and wheat, wheat and barley, barley and gram.
15. Himachal Pradesh	Wheat and barley, wheat and gram, wheat and mustard, maize and seasmum, maize and pulses, barley and gram.
16. Manipur	Peas and mustard, wheat and Bengal gram or pea, rice and chillies, cotton and ground-nut.

Other Cultural Practice : "Broadcasting" of seeds in the field is an old and orthodox method of sowing. Though it is gradually dying out, it still holds sway in predominantly tribal areas though it obtains in a few other regions also. In States like Orissa, paddy is "broadcast". It is argued that when the sowing season is brief, it is not possible to cover the entire area with line-sowing within that short period. In area where wheat is sown as a second crop and *ragi* sowing season is short, wheat also is sown "broadcast". In parts of Punjab both wheat and cotton are sown "broadcast". In these areas line-sowing is being introduced under the Five Year Plan programmes. In many parts of the country most of the crops except those transplanted are sown in line.

The technique of sowing "direct seeded rice" which is prevalent in the traditional rice areas, has now caught on in other areas as well and bids fair to be an important tool in bringing about the rice revolution. This technique helps to cut both time and cost as it does not entail any transplantation. The farmers find transplantation a costly operation and seem to be convinced that growing paddy directly from the seed is a better proposition. The "direct seeded rice" is grown in America in 100 per cent of the area under rice. In India, it is estimated, only 40 per cent would be under "direct seeded rice". In the Union Territory of Delhi the farmers had been so far used only to cultivation by transplanting the seedlings. For the first time, they are expected to switch over to "direct seeded rice".

Inter-culturing is done in line-sown crops with implements specially devised for the purpose. Enlightened farmers undertake frequent inter-culturing and weeding operations with implements. They undertake close weeding by hand and thus keep the growth of harmful

weeds to the minimum and turn the soil often enough to benefit from aeration, moisture and sunlight. The use of weedicides as substitute for intensive weeding has yet not spread, except for weeds that are persistent.

Weeds like *Kans*, once they strike root, spread rapidly, cover up the land and make cultivation impossible. Land covered by *Kans* goes waste. These weeds strike deep into the soil and ploughs with ordinary blades are of no help in removing them and reclaiming the land. These lands can be reclaimed only with the help of tractors and once reclaimed, continuous efforts are necessary to keep these weeds out. Frequent ploughing and weedicides are a good help. Land menaced by *Kans* weed is found mostly in Madhya Pradesh.

Tillage Practices : The primary object of tillage is to prepare a favourable seed-bed. The methods adopted for this purpose in India vary, but are usually effective. The land is worked carefully by the plough in the interval between two crops whenever there is the right quantity of moisture, which produces a layer of finely pulverized soil giving the most suitable conditions for germination. In heavy soils, the first tillage may consist of digging or deep ploughing. The cultivator's art consists largely in judging the right time to plough and in getting as much tillage done as is possible in the intervals between heavy rains or during the short period between the cessation of the rains and the sowing time.

Improved Seeds : Judicious selection of seeds and application of manure are both necessary for maintaining or improving land productivity. It is a common practice among farmers to select better grain for seed and preserve it till the next year. In years of scarcity due to crop failures, this process is disturbed. A large section of small farmers with poor means also finds it difficult to save grain for seed even in good years. They buy ordinary seed from the market. Improvement of seed was the first to claim attention of the State Departments of Agriculture. The progress achieved in research in this field was also comparable with that in any other country even as early as 1929 when the Royal Commission on Agriculture reported on the state of agriculture in India. However, the research was confined mainly to cash crops and particularly to cotton and sugar-cane. Wheat was the only grain for which improved strains were evolved. For wheat, the attempt was mainly to evolve a rust-resistant variety. With the introduction of the High Yielding Varieties Programme, cereals have taken precedence over cash crops. High yielding variety seeds of rice, wheat, *jowar*, *bajra* and maize are in the field since 1967-68. Recently, pulses, cotton and oilseeds have also received some attention and improved varieties of seeds have been evolved for them as well.

Seed Multiplication : The existing seed production and distribution arrangements were subjected to a detailed scrutiny by the Seed Review Team which reported in 1968. A number of shortcomings were brought to light. They included non-availability of quality breeders stock in adequate quantities as well as insufficiency of and lack of appropriate storage facilities on seed farms. The seed multiplication programme has not always yielded stock of the requisite purity. There have also been shortcomings in regard to the processing of seeds and the distribution arrangements.

The breeder seed is now sought to be produced in adequate quantities with the help of Indian Council of Agricultural Research and the National Seeds Corporation (NSC). The Corporation receives breeder seed from Research Institutions after the variety has been notified for release by the Central Varieties Release Committee. The production of foundation seed from the limited stock of breeder seed is taken up by NSC in the immediate next season to meet the immediate requirements. The Agriculture Universities are also involved in the process of the production of foundation seed.

For the production of certified seed, a number of agencies are involved including the State Seed Farms, Central Seed Farms, private seed producers and seed producers' co-operatives. It, however, takes one year before the foundation seed is made available to the various agencies which produce certified seed. The finally multiplied seed is thus made available to the farmers only in the second or third year. Although research in seed development started in 1929, no significant efforts had been made in the direction of a quality seed industry until 1963-64 when NSC was set up. In addition to the seed farms established by the State Governments, the Central Government has also set up large sized farms where the focus of activities has shifted to the production of seeds. Finally a beginning has been made in the organization of seed producers co-operatives through a scheme sponsored by the National Co-operative Development Corporation. The Tarai Development Corporation was established during 1970 with the assistance from the World Bank. In *kharif* 1970, paddy, maize, sorghum, and soyabean seeds were grown over an area of 4,000 hectares and in *rabi* 1970-71, 5,265 hectares were brought under wheat seed production. The total quantity of foundation seed produced by the National Seeds Corporation has increased from 4.37 tonnes in 1963-64 to 499.90 tonnes in 1970-71. Certified seed production increased from 2.44 tonnes in 1964-65 to 1574.16 tonnes in 1970-71.

Seed Distribution : Seed certification with its essential elements of field inspection of crops for varietal purity, proper isolation distance and supervision at harvesting has been generally lacking

for quite some time. Even though the Seeds Act was passed in 1966, certain sections of the Act could be brought into operation only in October 1969. A Central Seeds Committee has now been set up under the Act and a review of implementation of the Seeds Act in the various States was made at the Zonal Conferences during 1970-71. The State Governments are organizing training programmes for officials, extension agencies, traders, seed producers and farmers to bring home to them the salient features of the Seeds Act.

Recently an All-India Seed Certification Seminar was organized by the Agriculture Ministry to consider the establishment of a sound certification system in the country. The Seminar recommended that in each State there should be established a State Seed Certification Board independent of the agency producing and distributing seeds and of the enforcement of the Seeds Act. It also recommended that there should be a Central Seed Certification Board for co-ordinating the functioning of the State Boards and for laying down norms and standards for guidance. The recommendations of the Seminar have been accepted by the Government.

Area Under Improved Seeds : The object before the Fourth Plan was to cover nearly 72 million hectares under improved seeds—about 25 million hectares under high yielding varieties, 15 million hectares under multiple cropping and about 8 million hectares in assured rainfall areas and 24 million hectares in dry cultivated areas. High yielding varieties of wheat, rice, *jowar* and *bajra* were introduced during 1967-68 while those of maize have been made in the field for many years. Although a good deal of progress has been made under the programme, it has not, however, been uniform with regard to each of the crops. While nearly one-third of the area under wheat has been covered by the high yielding varieties, the corresponding figures for rice, *jowar*, *bajra* and maize are only 14.7, 5.4, 13.7 and 8.7 per cent respectively. The total area covered under wheat and rice during 1970-71 was more or less the same. The progress made in respect of wheat is remarkable in the sense that West Bengal, Orissa and Punjab have covered 88.4, 71.4 and 68.1 per cent of their wheat area under high yielding varieties. Haryana and Tamil Nadu have also half of the area covered. In the case of rice, on the other hand, but for Tamil Nadu and Jammu and Kashmir, the progress made is rather slow (Table XVII).

Among the non-food crops, cotton probably is the only crop, so far, for which improved seed is extensively used. The Indian Central Cotton Committee has been doing useful work in this direction. In regard to oil-seeds, progress on the whole is small, though regions like Andhra Pradesh, Tamil Nadu, Kerala and Punjab have shown

TABLE XVII

Area Under High Yielding Varieties—Cereals

State	Crop	1969-70			1970-71		
		Total Area ('000 hect.)	Area Under High Yielding Varieties ('000 hect.)	(4) as percentage of (3)	Total Area ('000 hect.)	Area Under High Yielding Varieties ('000 hect.)	(7) as percentage of (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh	Rice	3,300	522	15.8	3,396	599	17.6
	Jowar	2,724	21	0.8	2,511	81	3.2
	Bajra	602	23	3.8	584	73	12.5
	Maize	243	28	11.5	247	45	18.2
Assam*	Rice	2,243	102	4.5	2,100	150	7.1
	Maize	27	3	11.1	27	3	11.1
Bihar	Rice	5,493	324	5.9	5,232	405	7.7
	Maize	953	64	6.7	981	81	8.3
	Wheat	1,145	437	38.2	1,230	566	46.0
Gujarat	Rice	499	28	5.5	489	81	16.6
	Jowar	1,315	4	0.3	1,334	6	0.4
	Bajra	1,784	275	15.4	1,782	405	22.7
	Maize	291	8	2.7	275	12	4.0
	Wheat	433	17	3.9	577	41	7.1
Haryana	Rice	241	20	8.3	267	30	11.2
	Bajra	928	130	14.0	879	240	27.3
	Maize	109	12	11.3	112	10	8.9
	Wheat	1,017	440	43.3	1,118	600	53.7
Himachal Pradesh	Rice	97	18	18.6	105	32	30.5
	Maize	256	13	5.1	260	60	23.1
	Wheat	330	61	18.5	289	69	23.9

Contd.

TABLE XVII *(Contd.)*

State	Crop	1969-70			1970-71		
		Total Area ('000 hect.)	*Area Under High Yielding Varieties ('000 hect.)*	*(4) as percentage of (3)*	*Total Area ('000 hect.)*	*Area Under High Yielding Varieties ('000 hect.)*	*(7) as percentage of (6)*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Jammu and Kashmir	Rice	241	121	50.2	222	132	59.5
	Maize	256	3	1.2	269	12	4.5
Kerala	Rice	873	239	27.3	875	283	32.3
Madhya Pradesh	Rice	4,319	209	4.8	4,334	220	5.1
	Jowar	2,426	33	1.4	2,299	48	2.1
	Bajra	276	9	3.3	228	7	3.1
	Maize	62	21	3.4	590	22	3.7
	Wheat	3,176	150	4.7	3,328	220	6.6
Maharashtra	Rice	1,392	185	13.3	1,356	214	15.8
	Jowar	6,091	323	5.3	5,788	588	10.2
	Bajra	2,257	302	13.5	1,929	481	24.9
	Maize	54	8	14.8	42	9	21.4
	Wheat	865	152	17.6	882	202	22.9
Karnataka	Rice	1,106	121	10.9	1,160	162	14.0
	Jowar	3,154	147	4.7	2,594	182	7.0
	Bajra	567	22	3.9	510	55	10.8
	Wheat	327	36	11.0	305	47	15.4
Orissa	Rice	4,506	170	3.8	4,566	245	5.4
	Jowar	17	1	5.9	17	2	11.8
	Maize	72	5	6.9	72	10	13.9
	Wheat	15	7	46.7	14	10	71.4
Punjab	Rice	384	61	15.9	389	101	26.0
	Bajra	201	101	50.2	205	101	49.3
	Maize	563	81	14.4	572	81	14.2
	Wheat	2,162	1,418	65.6	2,200	1,499	68.1

TABLE XVII (*Contd.*)

State	Crop	1969-70			1970-71		
		Total Area ('000 hect.)	*Area Under High Yielding Varieties ('000 hect.)*	*(4) as percentage of (3)*	*Total Area ('000 hect.)*	*Area Under High Yielding Varieties ('000 hect.)*	*(7) as percentage of (6)*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rajasthan	Rice	115	10	8.7	119	16	13.4
	Jowar	1,167	9	0.8	1,184	10	0.8
	Bajra	4,346	191	4.4	5,127	290	5.7
	Maize	783	30	3.8	757	24	3 2
	Wheat	1,254	288	23.0	1,471	340	23.1
Tamil Nadu	Rice	2,695	1,142	42.4	2,686	1,518	56.5
	Jowar	732	10	1.4	749	12	1.6
	Bajra	459	69	15.0	490	80	16.3
	Maize	13	12	92.3	18	9	50.0
Uttar Pradesh	Rice	4,534	561	12.4	4,553	689	15.1
	Jowar	722	7	1.0	726	7	1.0
	Bajra	1,020	22	2.1	1,111	22	2.0
	Maize	1,505	81	5.4	1,497	25	1.7
	Wheat	5,378	1.640	30.5	5,863	1,863	31.8
West Bengal	Rice	5,016	459	9.2	4,949	567	11.5
	Wheat	240	174	72.5	320	283	88.4
All-India	Rice	37,680	4,342	11.5	37,432	5,501	14.7
	Jowar	18,605	555	3.0	17,435	936	5.4
	Bajra	12,493	1,155	9.2	12,907	1,769	13.7
	Maize	5,862	452	7.7	5,839	508	8.7
	Wheat	16,626	4,910	29.5	17,892	5,892	32.9

*Figures for Assam include those for Meghalaya.

considerable interest in spreading the improved varieties of oil-seeds. In the case of tobacco, there has been a shift from inferior to superior types like Virgina tobacco.

Manures and Fertilizers : Plants, like other forms of life, depend for their growth upon adequate supply of the necessary growth factors and the ultimate growth is conditioned by that factor which is scarce. In its tropical location, India enjoys a relatively long period of plant growth which helps the farmer to produce green manure or compost required for each field ahead of the main crop. In most other countries, this is possible only at the expense of a major crop during a complete growing season. Besides, potash—an expensive plant nutrient—is found in abundance in Indian soils. The main deficiency is in soil nitrogen resulting from intense biological activity in the soils under tropical conditions. At higher levels of production, particularly in the case of a crop like wheat, the emphasis now is on a balanced use of fertilizers which also includes micro-nutrients like zinc and copper. The Fourth Plan target for fertilizers has accordingly been put at 3.2 million tonnes of nitrogen, 1.4 million tonnes of of P_2O_5 and 0.9 million tonnes of K_2O. The consumption levels during 1970-71 as against this were 14.26 lakh tonnes of N, 4.61 lakh tonnes of P_2O_5 and 2.26 lakh tonnes of K_2O (Table XVIII).

The organic manures like farm yard manure, compost manure and green manures are locally available. Farm yard manure consists of cattle dung and other waste materials including foliage found in fields. In terms of soil nutrients, the average composition of farm yard manure obtained in India is of the order of 0.3 per cent of N, 0.15 per cent of P_2O_5 and 0.3 per cent of K_2O as compared to about 1.3, 0.3 and 1.0 per cent respectively of these nutrients in other countries. The low soil nutrient content is largely due to inefficient methods of preparation of farm yard manure. In most cases, the farm yard waste and dung are collected in uncovered heaps or dumped in ditches. Animal urine is rarely utilized for the purpose. Livestock and human excreta along with their urine, if fully utilized is a potential source of over 16.0 million tonnes of nitrogen, 6.1 million tonnes of P_2O_5 and 16.7 million tonnes of K_2O.

Composting of farm yard manure is recommended to improve nitrogen content and to increase the total organic material in the soil. Town compost comprises of such organic materials as night soil, slaughter-house refuse, etc. These are useful for maintaining the texture of the soil under Indian conditions. Whereas rural compost is produced and consumed locally, urban compost has to be transported to consumption centres and the transport costs and other difficulties limit its utilization.

TABLE XVIII

Consumption of Nitrogen in India During 1965-66 to 1970-71

('000 tonnes)

State	*1965-66*	*1966-67*	*1967-68*	*1968-69*	*1969-70*	*1970-71*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	78	155	147	180	311	286
Assam	3	2	3	4	7	9
Bihar	27	46	56	60	110	100
Gujarat	28	37	47	70	108	128
Haryana	—	(a)	31	53	52	72
Jammu and Kashmir	2	3	18	N.A.	4	5
Kerala	12	27	17	25	72	52
Madhya Pradesh	15	36	21	22	52	81
Maharashtra	6	6	95	130	150	199
Karnataka	33	46	60	60	132	156
Orissa	13	13	13	20	26	26
Punjab	55	59	90	132	174	201
Rajasthan	6	12	19	23	41	48
Tamil Nadu	82	89	129	108	222	259
Uttar Pradesh	84	71	169	230	459	400
West Bengal	27	30	34	30	56	73
Other States	104	104	85	62	15	18
Total	575	736 (28)	1,034 (40)	1,209 (17)	1,991 (65)	2,113 (6)

Notes : 1. N.A. : Not Available
2. Figures in brackets represent percentage change over the previous year.
3. (a) : Below 500 tonnes

Use of organic manures in conjunction with chemical fertilizers is essential for preserving the nutritional balance and fertility of the soil. Production and utilization of organic manures, therefore, constitute an important activity under the agricultural production programme. During 1970-71, the anticipated production of rural compost was estimated at about 155 million tonnes compared to about 145 million tonnes in 1969-70. Stress is laid on utilization of farm and cattle wastes, green leaves and shrubs and trees, water hyacinth and tank silt for composting or direct use under the urban compost scheme. About 4.3 million tonnes of compost was to be made available for distribution during the year 1970-71 under the scheme. The project for the setting up of pilot compost plants for manufacturing organic manure from city wastes as envisaged under the Fourth Five Year Plan is also expected to be initiated. Schemes for sewage/sullage utilization, which provide irrigation water as well as plant nutrients and organic matter are in progress.

Green manure is widely used in irrigated crops, particularly rice and wheat. For green manuring, crops like horsegram (*Dolichos biflorls*) and Bombay hemp (*Crotalaria juncea*) are grown before the main crop is sown and they are subsequently buried in the soil. The coverage under green manuring increased from 8.5 million hectares during 1969-70 to an anticipated level of 10.4 million hectares in 1970-71. The progress of green manuring has been encouraging in States like Uttar Pradesh, Andhra, Tamil Nadu and Orissa. The green manuring programme under the Fourth Five Year Plan has been included in the intensive rotations which are being developed.

Besides the above organic manures which are sometimes referred to as bulk organic manures, there are concentrated organic manures in use like oil cakes, bonemeal, dried blood, horns and hoofs, etc.

The most important nitrogenous chemical fertilizers are ammonium sulphate, ammonium nitrate, ammonium calcium nitrate and urea. The important phosphatic fertilizers are superphosphate, rock phosphate, and ammonium phosphate. In the past 50 years, several types of nitrogenous and phosphatic fertilizers were introduced in India and tried at different experimental stations. But a systematic effort to manufacture and popularize them was under the Five Year Plans.

Manufacture of nitrogenous fertilizers in India was taken up on a big scale with the Sindri Fertilizer Factory going into production in 1951. Since then there has been a big spurt in the production and consumption of fertilizers (Table XIX). According to the annual review of production and consumption of fertilizers in 1970-71, the output of nitrogenous fertilizers was 879.8 thousand tonnes. Consumption during the period was about 1,425 thousand tonnes, the production

TABLE XIX

Production, Imports And Distribution Of Fertilizers

1952-53 to 1969-70

(Tonnes)

Year	Nitrogen (N)			Phosphoric Acid (P_2O_5)[1]			Potash (K_2O)	
	Produced	*Imported*[2]	*Distributed*[3]	*Produced*	*Imported*	*Distributed*[4]	*Imported*	*Distributed*[5]
1952-53	53,067	44,294	57,822*	7,445	—	4,552	3,311	—
1953-54	52,905	19,346	89,287*	13,831	—	8,261	7,490	—
1954-55	68,478	19.984	94,810*	14,345	—	15,027	11,097	—
1955-56	76,859	53,370	107.495*	12,365	—	13,018	10,295	—
1956-57	78,788	56.768	123,054*	17,585	—	15,874	14·791	—
1957-58	81,144	110,100	149,019*	25,785	—	21,922	12,786	—
1958-59	80,766	97,540	171,988*	30,987	—	29,490	22,366	—
1959-60	83,694	142,335	229,326	51,407	3,819	53,930	33,103	21,342
1960-61	111,987	171,926	211,685	53.722	128	53,134	24,845	29,052
1961-62	154,326	142,920	291,536	65,360	645	63,932	30,381	27,982
1962-63	194,194	229,462	360,033	88,300	7,959	81,385	44,276	36,503
1963-64	219,072	197,691	(406,976) 425,872	107,836	12,267	(116,674) 120,847	64,060	(50,570) 51,860
1964-65	243,230	256,517	(434,473) 492,249	131,021	12,293	(147,652) 148.530	57,176	(70,440) 71,640

TABLE XIX (*Contd.*)

Year	Nitrogen (N)			Phosphoric Acid (P_2O_5)[1]			Potash (K_2O)	
	Produced	*Imported*[2]	*Distributed*[3]	*Produced*	*Imported*	*Distributed*[4]	*Imported*	*Distributed*[5]
1965-66	237,889	376,270	(547,363) 582,588	118,779	21,766	(132,178) 134,075	93,641	(77,746) 89,631
1966-67	308,993	574,628	(838,736) 830,171	145,678	129,158	(248,602) 274,601	143,337	(115,710) 133,666
1967-68	402,648	975,897	(1051,785) 1135,655	207,145	370,776	(422,096)** 438,168**	276,465	(205,578) 205,750
1968-69	562,981	780,052	1222,398 (1,253,953)	213,229	90,828	296,140 (318,351)	165,183	164,077 (177,567)
1969-70	730,428 (704,332)	574,428	1006,878 (1040,198)	223,686 (224,712)	88,508	236,767 (234,989)	99,928	151,227 (131,919)

Note : (i) The all-India figures have been arrived at by converting fertilizer materials into nutrients.

(ii) From 1963-64 onwards brackets figures are on April-March and others on July-June basis.

1. Excludes data in respect of bonemeal and rock-phosphate.
2. Figures from 1952-53 to 1957-58 are on April-March basis.
3. Figures from 1952-53 to 1956-57 relate to calendar years ending in the first half of the period stated while from 1957-58 to 1962-63 they are on April-March basis.
4. Figures from 1952-53 to 1957-58 refer to calendar years ending in first half of the period stated while from 1958-59 to 1962-63 they are on April-March basis.
5. In the case of potash from 1952-53 to 1958-59, in absence of distribution figures the quantity imported is taken as distributed. Figures relate to financial year April-March.

* Allotments of fertilizers under the "Central Fertilizer Pool".

** Figures incomplete for lack of details of despatches relating to production of 15,662 tonnes of N and 8,546 tonnes of P_2O_5.

during 1971-72 was estimated at 1,042 thousand tonnes against projected offtake of 1,625 thousand tonnes.

The phosphatic fertilizers produced and consumed in India are mostly in the form of superphosphate. Until 1956, these fertilizers did not become popular. But it was realized that continuous use of nitrogenous fertilizers alone would deplete the phosphorus content of the soil unless the latter was adequately replaced. Hence, the Government propagated the use of balanced fertilizers containing all plant nutrients in the form of manure mixtures. Production of phosphatic fertilizers rose from 223.3 thousand tonnes in 1969-70 to 248.8 thousand tonnes in 1970-71. The growth in the output of phosphatic fertilizers is largely due to the improvement in the availability of the basic raw material—rock phosphate from mines in Rajasthan and Andhra Pradesh.

The consumption of potassic fertilizers is mostly in the form of muriate of potash and sulphate potash which are mainly imported, local production being negligible. The consumption of potassic fertilizers grew from 209.8 thousand tonnes in 1969-70 to 226.2 thousand tonnes in 1970-71.

There have been region-wise disparities in the production and consumption of fertilizers. The Southern and Northern regions accounted for more than a third of the country's consumption of all nutrients, with the South being marginally ahead due to the comparatively higher share in the offtake of potassic and phosphatic fertilizers.

The present installed capacity is of the order of 1,344 thousand tonnes of nitrogen and 421 thousand tonnes of phosphatic fertilizers (in terms of nutrients). Additional projects under implementation would have a capacity of 1,848 and 778 thousand tonnes respectively for the two categories of fertilizers. India has in a way to invest Rs. 225 crores a year to meet its growing demand for fertilizer. The problems faced by developing countries like India in the field of fertilizer industry include external and internal finance, foreign exchange needed for import of spare parts, lack of properly trained personnel and marketing and credit facilities. At the top of that, farmers have also to be educated on the need to use fertilizers.

Promotion Effort : A number of measures have been taken by Government to promote the optimum consumption of fertilizers. Fertilizer manufacturers and State Governments have been asked to hold demonstrations of the characteristics of various types of facilities and organize training of extension personnel, fertilizer dealers and salesmen. A syllabus has also been drawn up for training

fertilizer dealers. The State Governments have been asked to strengthen and utilize fully their soil testing facilities so that soil test results are made available to the farmers within 10 to 15 days after the receipt of the soil sample.

Under the Programme of National Demonstrations and in the context of Farmers' Training and Education (with special emphasis on practical scientific demonstrations on farmers' fields) close attention is being given to the application of prescribed dosages of fertilizers in a balanced way. Information and publicity media are being used for promoting larger fertilizer consumption. The Government have also under consideration proposals for setting up a Fertilizer Promotion Council as a joint venture of the Government of India, State Governments, the industry and agro-industries for promoting optimum and balanced use of fertilizers.

The Central Fertilizer Control Laboratory is being established which will act as a reference laboratory and will train the inspecting staff of the State Governments in drawing and analyzing fertilizer samples.

Crop Diseases, Insects and Pests : The loss entailed as a result of damage caused by diseases, pests and insects to crops at various stages of growth from sowing to harvesting, storage and in transportation is estimated to be 20 per cent of total crop output. The prevention of this damage is therefore important.

Nearly 40 diseases and over 85 species of insects are known to attack the rice crop in the field and in storage. The most widely prevalent and destructive diseases are blast, helminthos, poriose, stem rot, foot rot and physiological root rot. Among the insects and pests, stem borers, swarming caterpillars, mispa, grass hoppers, gundhi bugs and gall fly are most prevalent and most destructive in the field. During storage nearly 12 different insects damage the grain.

In the new agricultural technology, plant protection has acquired an added significance. This is due both to technical and financial reasons. In the case of high yielding varieties, conditions which are conducive to the growth of the plant population are also favourable for weeds, pests, and diseases. Moreover, the high yielding varieties necessarily entail a high cost of cultivation and hence a cultivator can ill-afford to lose his crop. If full benefit is to be derived from the costly inputs, plant protection measures in various forms, such as seed treatment, weed control and post-sowing prophylactic treatment, must be made an integral part of agriculture practices.

Millions of tonnes of wheat were destroyed by a big rust epidemic in 1947 and 1954. In 1950-51 and 1957-58 the potato disease appeared over a wide area in the plains of Bihar, Uttar Pradesh and Punjab and caused a loss of over 50 per cent of the crop. There was

a sudden eruption of pests and diseases on an area of 1.0 million hectares during 1969-70. The area affected during 1970-71 was nearly 4 lakh hectares spread over the States of Andhra Pradesh, Bihar, Jammu and Kashmir, Madhya Pradesh, Maharashtra, Karnataka and Rajasthan.

Four types of methods are adopted for preventing damage to crops by insects and pests. They are classified as : (1) Quarantine, (2) Biological Control, (3) Cultural Methods, and (4) Chemical Treatment.

In the past, owing to lack of efficient quarantine arrangements, injurious insects and pests entered the country and spread widely. Quarantine and fumigation stations have now been set up at Madras, Calcutta and Bombay. Besides, based on the knowledge of the existing pests and diseases in the country, plant quarantine measures are being taken to prevent the entry of diseases and pests through inter-State movement of plant materials.

Biological control of insects and pests, in which the natural parasites and predators of the pests are exploited to destroy the pests, has met with considerable success. A well-known example of such control is the use of the cochineal insect for the eradication of the prickly pear. Considerable work has been done in the country after independence on the science and practice of biological control ; pest control methods have been in operation against sugar-cane borers and nephenthes of coconut in the South. Biological control research is conducted at the Indian Agricultural Research Institute.

In the case of some pests and diseases, physiological and agronomical methods are used to control their incidence. Adjustment of planting dates, mixed cropping or crop rotation, judicious manuring or supplying balanced fertilizers, controlled irrigation, etc. constitute economical and fruitful methods of protection against the disease or pest incidence. A change in the time of sowing wheat was a major factor in Hessian fly control and a similar method has dealt effectively with the Tirak disease in cotton. The limitation of the method is that a variation of cultural practice which prevents the onset of the disease or pest has also an adverse effect on crop yields and the cultivator prefers the former risk at times.

Another very successful line of the attack is the cultivation of varieties resistant to pests and diseases. Seed treatment is the first critical stage of plant protection according to the Fourth Five Year Plan. Dressing the seed with chemicals before sowing protects it from seed and soil borne diseases and is essential for increase of plant population which is responsible for the yield potential of the new varieties. Seed treatment is proposed to be given to 26 million hectares during the Fourth Five Year Plan.

The use of insecticides and fungicides is adopted extensively in the country for eradication of pests and diseases. Powerful insecticides like chlorinated hydrocarbon compounds and organo-phosphorous compounds are revolutionizing the methods of control of insects and pests. Some of the organo-phosphorous compounds are systematic in their action as they are absorbed by plants and are translocated to different parts of the plant. Likewise, systematic fungicides are also being developed. Many antibiotics have been used successfully for the control of bacterial plant diseases.

Laboratory experiments have proved conclusively that by spraying a mixture of a paraffin-based oil and insecticide, the white fly can be killed almost instantaneously. At the U.P. Agriculture University's Experiment Station, a plot of pulse crop sprayed with the mixture has remained unaffected though it is surrounded by crop affected by yellow mosaic.

Post-sowing intensive prophylactic treatment constitutes the main plank of the plant protection programme. In the Fourth Plan, a target of 34 million hectares is envisaged for this purpose. In order to be effective, this programme will require two main supporting measures. The first relates to organization of a surveillance and warning system. The second is intensive research on determination of the most effective chemical control measures for various pests and diseases. It is intended to give attention to both these aspects in the Plan.

Weed control is another important aspect of plant protection. Such control through manual labour has obvious limitations in high density crops. Hence there is need for increased stress on chemical weed control measures. Since 1964, co-ordinated control trials on paddy have been conducted with satisfactory results. The Plan envisages a target of 2 million hectares for weed control.

Besides seed treatment, weed control and prophylactic spraying, other measures envisaged relate to rat control and control of epidemics. For anti-rat operations, a target of 10 million hectares is envisaged. For all the plant protection programmes taken together, it was contemplated that about 80 million (gross) hectares will be covered by the end of the Plan.

Effective adoption of plant protection measures by cultivators is often inhibited by two among other factors, namely, lack of technical skill in the use of pesticides and ineffectiveness of individual operations. In this context, the Plan envisages strengthening of the official plant protection services and expansion of training facilities. Steps will also be taken to strengthen the agro-aviation arrangements both in the public and the private sector. In the endemic areas, repeated aerial spraying is envisaged for eradication of pests and

diseases. Such spraying is proposed to be financed by the Centre while the cost of the material used will be borne by the States.

Unlike chemical fertilizers, plant protection material is still largely distributed by official agencies. It is estimated that, at present, about 50 per cent is handled by Government personnel. Co-operatives and panchayats, account for about 25 per cent and the balance is retailed by private dealers and manufacturers. It is estimated that by 1973-74 the annual consumption of pesticides should go upto 66,000 metric tonnes of technical grade material as against the present annual consumption of 40,000 metric tonnes. If this is to be accomplished, vigorous action by the industry, Government and the co-operative organizations will be necessary. Plant protection measures benefited a gross area of 48 million hectares during 1969-70. The target for 1970-71 was fixed at 52 million hectares.

The locust menace causes considerable damage. During the present century, there have been five locust cycles during which Rajasthan, Punjab, Saurashtra, Kutch, Gujarat, and parts of Maharashtra State, were affected. The permanent homes of locusts lie in extensive belts in Africa and countries of West Asia. Locusts attack not only agricultural crops but also forests and all types of green vegetation. The Government of India have maintained a Central Locust Organization to fight this menace and adopted measures which include spraying and dusting of chemicals on a large scale in the breeding areas in India. The attacks on crops in the cultivated area met by mechanical and chemical methods such as the destruction of eggs by exposure after ploughing, burying them in trenches, etc. To intensify the campaign, aeroplanes, helicopters and other equipment are being obtained under the Technical Assistance Programme.

Implements : Indian tillage implements are few, simple in design and indigenous in pattern and locally manufactured. The design of each implement varies in detail from region to region to suit local needs and conditions. Not all implements are used in all regions. The use of some is restricted to a few. Since the commencement of the Third Plan, a number of steps have been taken to develop improved agricultural implements. While some success was achieved, parts of the programme continue to suffer from a variety of shortcomings, such as lack of suitable designs, high cost of manufacture and lack of adequate facilities for sale and repair. These problems will receive attention through intensification of research in agricultural engineering, and improvement of arrangements for fabrication and distribution of implements. Considering that there are nearly 70 million draught bullocks, the scope for improved animal drawn equipment is enormous and their contribution to productivity can be significant. It is estimated that animal drawn seed drills and planters can save

upto 40 per cent of the time compared with broadcast sowing. Hence stress will continue to be laid on the programme for animal drawn implements and hand tools.

The most common implements are: (i) ploughs, (ii) harrows, (iii) clod-crushers, (iv) seed-drills, (v) hoes, (vi) rollers, (vii) levellers, (viii) riders, and (ix) harvesting implements.

Plough is the primary implement used all over India. *Desi* ploughs have almost a common design and they differ mostly in size, depending on the type of soil and the size of the bullocks used in particular areas. The heaviest ploughs are found in the black cotton soil areas of India. The *desi* plough is almost like a western style cultivator.

All indigenous ploughs are similar in design, but vary considerably in size and weight to suit the prevailing soil types, ploughing conditions and the weight and height of draught animals in the locality. Heavy indigenous ploughs are being gradually replaced by mould board ploughs which have greater operational efficiency. The blade of the indigenous plough is designed to plough upto 15 cm. deep. It stirs but does not turn the soil. The working draught varies from 27 to 159 kg.

The harrow is mainly used as a secondary tillage implement. It supplements the work of a plough for preparing the seed-bed for crops and for covering the seeds after sowing. In lighter soil, harrows are used for ploughing also. The useful life of a harrow ranges from 2 to 6 years. The clod-crushers are used immediately after ploughing and harrowing. Heavy wooden logs or planks are used for crushing the clods. The practice of drilling seeds is fairly wide-spread throughout India except in Assam and some parts of West Bengal, Bihar, Kerala, and the Konkan coast. Transplants paddy is a major exception ; drilling is not possible in its case. The simplest seed-drill consists of a vertical tube with a seed-bowl and is fitted with a shoe-piece and a wearing point at the lower end. The simple type of seed-funnel is used mostly in tribal areas. There has been a steady growth in the demand for seed-*cum*-fertilizer drills and seed-planters which are not yet readily available in the country. Efforts are being made to produce them in the country.

The hoe is an all-purpose farm implement used for many cultural operations—preparing small seed-beds, for forming ridges, for bunds, and water courses and channels. It is also used for removing stalks of harvested plants, for harvesting root crops such as potato and ground-nut and for thinning of "broadcast" as well as drilled crops. All the indigenous manually and bullock drawn hoes are generally manufactured by the village artisans and the material for its construction is supplied locally. The cost and durability of a hoe are similar to that of a harrow.

The use of rollers is wide-spread particularly in areas where dry farming is practised in order to make the seed-bed compact and thereby facilitate the germination of seeds.

The most common type of harvesting implement is the hand sickle with a plain blade. Scythe, an improvement over sickle, is not in common use.

Improved Implements : Marginal changes in the design of different implements have been introduced at various stages of development. Attachments to seed-drill help spreading manure along with seeds, attaching wings to harrow to perform close weeding and iron mots (water lift) instead of leather mots are some of the improvements introduced by local craftsman to meet the changing demand. The Departments of Agriculture in States also carry out engineering research and they have produced iron-plough, Olpad hoe, Baroda hoe, chaff-cutter, winnowing fan, plant-pullers, improved sugar-cane crusher, improved furnace for boiling sugar-cane, dust guns to spray pesticides, etc. Some of the improvements have been adopted from designs obtained from advanced countries and adopted to local needs. As a result of research, some implements like the simple axe and the spade have undergone changes in design. The use of shovel in place of the spade makes lever action less arduous. Carts have now pneumatic tyres to reduce the strain on animals. Not all these improved implements are used all over the country : chaff-cutters are widely used in Punjab, and iron-ploughs in Saurashtra and Maharashtra. There are other improved implements which are mostly of imported design such as tractors, oil-engines, electrical motors, power driven sugar-cane crushers, etc.

As for the power driven machinery, use of tractors and other agricultural machinery and equipment is gaining popularity. The number of tractors in use has doubled in the last 5 years rising to the level of 108 thousand units in 1969-70. In the same period the number of indigenously manufactured tractors has nearly doubled to the level of 17.1 thousand. The demand for power-tillers and combined harvestors is also rising.

Successive bumper crops of wheat during the past few years and inclement weather immediately after harvesting of wheat has necessitated the introduction of combined harvestors and threshers. To avoid harvesting losses, it has been decided to import labour saving harvesting machines; arrangements have been made for the import of 75 combined harvestors. The programme for 1970-71 was to import about 300 combines both on cash and barter basis. Power-threshers, which were concentrated mainly in Punjab have become quite popular in the neighbouring States of Haryana, Uttar Pradesh and Rajasthan. Power paddy-threshers were introduced

only very recently and are gaining popularity in the eastern and southern States. Power maize-shellers are in common use in Punjab and are also getting popular in Maharashtra and Andhra Pradesh.

There are at present 5 units which produce tractors in the country in the range of 20-25 h.p. With a total capacity of 30,000 units per annum, actual production has been well below 20,000. Further capacity of 31,000 units has been sanctioned and the Agriculture Ministry is of the view that this will fully meet the internal demand for tractors.

Agro-industries Corporations have been set up in all the States except Nagaland and Meghalaya. In the initial stages, all these Corporations concentrated mainly on the distribution of tractors, power-tillers and pump-sets and other items of agricultural machinery on cash and hire-purchase basis. Presently all imported tractors are being distributed through these Corporations with a view to eliminating black-marketing and ensuring their supply to farmers at fair and reasonable prices. The Corporations have also been directed to set up agricultural machinery hiring centres with a net-work of sub-centres and workshops for providing hiring facilities to medium and small farmers. The Corporations in Assam, Andhra Pradesh, Bihar, Haryana, Kerala, Karnataka, Uttar Pradesh, Madhya Pradesh, Orissa, Tamil Nadu, Punjab, Rajasthan and West Bengal have set up 71 hiring centres and workshops. Some Corporations have also introduced mobile workshops for providing after-sales facilities in the interior where regular workshops do not exist.

IX. Finance

Agricultural Credit Situation : The salient features of the present day agricultural credit situation in the country are stated here briefly :

1. The majority of Indian farmers are small holders and belong to the low income group. According to creditworthiness, the agriculturists may be classified into three categories : (a) Creditworthy—those who satisfy all sound banking rules to obtain adequate and necessary credit ; (b) Potentially Creditworthy—those whose income can be sufficiently raised to make them fully creditworthy by providing proper credit and technical assistance; and (c) Non-Creditworthy—those who lack sufficient land and do not have any alternative source of income and whom credit alone cannot help in improving their income to the extent that they may be able to make their both ends meet. Most of the farmers fall in

the second category. For certain kinds of loans, e.g. loans for land reclamation, irrigation, permanent improvements, and purchase of heavy and costly equipments, a large number of farmers in the first category may also have to be down-graded to the second one.

2. The inadequate growth of institutional credit agency and extreme dependence of the farmer on the private money-lender have led to very unpleasant consequences. Indian agriculture is suffering badly from want of capital. It is the mainstay of about 70 per cent of the total population, yet it is the most capital starved industry in the country. This has been responsible for the static or even retrogressive condition of Indian agriculture today. The lack of capital in agriculture is not a new malady; it is very old and chronic. The credit requirements in farming are so large that private individual resources can never fully meet them. If, in the past, the drawbacks resulting from the lack of adequate capital were not so obvious, it is because agriculture then followed a subsistence and extensive cultivation pattern and money had not assumed the importance as it has now. Today, for achieving the objectives of intensive cultivation, high yields, increased income, adoption of technical and technological improvements, the use of more and more capital in farming is an absolute necessity.
3. The cumulative effect of agricultural debt legislation during the last quarter of the century and of the more recent land reform measures has been further to contract agricultural credit facilities.

Need for an Institutional Credit Agency : For progressive agriculture, adequate agricultural credit facility is essential. It is axiomatic that the credit requirements in agriculture cannot be met by private individual resources alone even when the money-lender is not fettered by any legal restrictions in his credit operations. Moreover, profit being the sole guiding consideration of the private agency, credit from the money-lender cannot be canalized to uses which are socially most desirable nor it can be made available to farmers who are not creditworthy under strict banking rules. The returns from capital investment on certain types of agricultural improvements are so low that these improvements can only be taken up if credit is made available at exceptionally low rates of interest and for a long term. As the agriculturist needs credit at specially favourable terms, an effective control over its use becomes a social obligation. That is why public and expert opinion now favours an institutional agency for agricultural credit. Institutional credit system has actually been

developed with liberal State assistance in most countries of the world during the present century.

Another strong point in support of the institutional system is that agricultural credit is no more interpreted in the narrow sense of merely granting of loans. It has a much broader cannotation now and combines in itself both technical guidance and planning of the farm business. The farmer is not only to be helped with a loan but he has also to be given the necessary guidance to make the most effective use of it so that he may maximize his earnings from land. It is increasingly felt that, if the farmer who is taught the improved methods of farming, is not provided with the means for carrying them out, no useful purpose will be served by merely expanding the agricultural extension services. Therefore, the credit services and the agricultural extension services in other countries work in close collaboration. There can be no doubt that to dispense with this type of credit among the farmers and also for its recovery, there cannot be a more suitable organization than that of village co-operatives. The idea of co-operation, particularly in agriculture is inherently sound. If life has been lacking in agricultural co-operatives so far, it is mainly due to poor management for which lack of proper internal leadership is chiefly responsible. This and the absence of a well defined co-operative loan policy together explain the paradox of funds lying idle with co-operatives and agriculture suffering for want of finance.

However, for improving management through either the development of internal leadership or official assistance, the situation is now favourable. Under various schemes such as Community Projects, National Extension Blocks and reorientation of education with greater agricultural bias as in Uttar Pradesh, the services of a very large number of trained village and group level workers have become available for proper guidance and even actual management of the village co-operatives.

Credit Agencies: Besides the private money-lenders and professional agriculturists etc., the main source of credit till recently has been the Government and co-operatives. These institutions played only a small role for quite some time. Co-operatives provided only 3 per cent of the borrowings in the year 1950-51. This went up to 15.5 per cent during the year 1961-62 and there has been a remarkable improvement during the last decade. As a result, co-operatives today account for as much as 30 per cent of the total credit requirements of the cultivators.

During 1969-70, short and medium-term credit advanced by these co-operatives was estimated to be of the order of Rs. 526.74 crores and it was expected to go upto Rs. 615.04 crores by 1970-71. In the

sphere of long-term developmental finance for agriculture, land development banks constitute the main source for credit. These banks which provide credit to farmers for land development, minor irrigation and purchase of expensive farm machinery, have also made sufficient progress. While the quantum of fresh long-term loans issued by the Co-operative Land Development Mortgage Banks was Rs. 58 crores in 1965-66, it was estimated to be Rs. 155 crores in 1969-70 and is expected to be still higher during 1970-71. The public sector institutions *viz.*, the Reserve Bank of India, Life Insurance Corporation and the State Bank of India provide support to the debenture floatation programme of Co-operative Land Development Mortgage Banks. The Government of India have also been purchasing the debentures during the Fourth Plan period to fill the gap in the availability of long-term resources for investment in agriculture. An amount of Rs. 17 crores was utilized during the year 1970-71.

Taccavi loans are being provided by some of the State Governments. Procedures for distribution and recovery of *taccavi* loans, by and large, approximate to the co-operative loans. The Government of India also provide short-term credit to the State Governments for giving *taccavi* loans. During the year 1970-71, a budget provision of Rs. 60 crores was made for this purpose, which was utilized in full.

Institutional finance for agricultural development is also being supplied by the 17 Agro-Industries Corporations set up in various States. Many of these Corporations provide additional line of credit to cultivators for the purchase of tractors and agricultural machinery under hire-purchase schemes.

The Agricultural Refinance Corporation was given statutory shape on May 1, 1963 with an issued share capital of Rs. 5 crores. Like other financial agencies, it does not involve itself in direct financing to the agriculturists but operates through the established long-term financial institutions in the co-operative sector. The Corporation's special schemes are intended to be implemented within compact areas with close supervision, economy in administration, co-ordination among technical and non-technical agencies and necessary State assistance. In recent years, it has been playing an extending role in supporting agricultural development specially minor irrigation.

The gigantic financial cost of ensuring complete modernization of India's agriculture will have very little chance of being realized unless there is some dramatic change in banking traditions and the rural credit system. The total short-term credit needs by the end of 1973-74 were estimated at around Rs. 2,000 crores, which no single institution could possibly finance. Since co-operatives alone could

not meet this challenge, it was thought necessary to bring in commercial banks which had so far played only a minor role in agricultural finance.

Commercial Banks : With the green revolution in agriculture in 1967-68, there arose the need for an increasing quantum of credit for procurement and distribution of various inputs. The present set up of co-operative credit structure, with the primary agricultural society as its base, is unable to absorb all the credit provided to it. There were problems of overdues. The requirements of the agricultural sector are so large and diverse that both the commercial banks and co-operative banks can play a mutual complementary role.

In areas where central co-operative banks are weak, the commercial banks have now been brought into the picture for financing good working primary agricultural credit societies, which were starving for want of finance from major financing institutions. This scheme has been introduced in the States of Andhra Pradesh, Haryana, Madhya Pradesh, Karnataka and in selected districts of Uttar Pradesh.

Commercial banks have also started playing a larger role in the financing of agricultural development. The level of direct financing by commercial banks for agriculture rose from about Rs. 44 crores on June 30, 1969, to Rs. 184 crores on June 30, 1970, and further to Rs. 217 crores on September 30, 1970. The total number of accounts under direct finance were 8.18 lakhs on June 30, 1970, which went upto 9.54 lakhs by September 30, 1970.

The Agricultural Finance Corporation set up by the major commercial banks, before nationalization, has also been playing a significant role in the field of agricultural credit. The total outlay on schemes approved by the Agricultural Finance Corporation has risen to the level of Rs. 108.22 crores for 25 schemes as on July 10, 1970. This Corporation guides major commercial banks for taking up special projects for agricultural development and also acts as a co-ordinating agency. The National Level Consultative Committee formed in June 1969 is helping the commercial banks and financing agencies in this regard. Among the schemes for which loans have been sanctioned by this Corporation, special mention may be made of seven loans amounting to Rs. 39.39 crores to the State Electricity Boards for energization of irrigation wells.

The Reserve Bank has decided to appoint major banks as "Lead" banks for various districts in the country. Such banks are expected to assume an important role in the development of banking and credit in the allocated districts. Their role will be to act as consortium leaders. After identifying the areas requiring branch expansion and the areas suffering from credit gaps, it should invoke the

co-operation of other banks in the districts for opening new branches as well as meeting credit needs.

X. Marketing

Marketing of agricultural produce is a complex activity. It embodies the various functions, such as, assembling, grading, standardizing, packing, storing, processing, financing, transport and communications. Market news and information have also an important role to play.

Market Functionaries : The human agency in the marketing process is an important consideration. The functionaries of the various marketing activities at market places adopt their own techniques of operation, procedure of business and trading practices. Techniques of marketing and organization vary in accordance with the economic conditions, nature of the marketable product, the area and location of marketing, marketing agencies and the rate of technical and commercial development.

There are several types of functionaries in the *mandi* such as *arhatiyas* or commission agents, *dalals* or commodity brokers, general agents, and agents for specific commodities and purposes. The agencies in the chain of marketing from the producer to the manufacturer and the consumer depend upon the nature of the crop also.

Types of Markets : Markets for agricultural commodities can be broadly classified into three groups : (i) *hats* and *shandis* ; (ii) wholesale markets or *mandis* ; and (iii) retail markets. *Hats* and *shandis* are markets periodically held, the former usually once or twice a week and the latter either at long intervals or on special occasions. Agricultural produce or livestock or both are sold in these primary markets, which number about 22,000 and are located mostly in the interior of the country. The areas served by a *hat* vary considerably. In some cases they are only villages while in others they may extend over a radius of 100 to 115 kilometres. They can also be termed as primary markets.

Mandis or wholesale markets form the most important part of agricultural market structure. There are about 1,700 wholesale markets in the country. Most of them command quite a large area and the produce is brought for sale from the primary markets, by the producers direct or by the middlemen such as village merchants, itinerant dealers, and agents of traders in the *mandis*.

Most *mandis*, particularly those in the producing areas, function as both primary and secondary markets. Primary markets are those where bulk of the produce is brought by the producer himself for sale,

The primary markets serve as feeding centres for the secondary markets which are usually wholesale markets and serve as second point of assembling, the first being the primary markets, Markets from where the produce is exported outside are known as terminal markets. A terminal market could also be a primary and secondary market.

The bulk of marketed surplus of the farmers is usully sold in the village. The All-India Rural Credit Survey shows that about 65 per cent of the total sales of crops are effected in the village. There are many reasons for the bulk of the produce being sold by the farmer in the village. The farming units are small; many farmers do not possess means of transport. Road development is not quite adequate, farmers are illiterate and the market information service is yet to have ramifications in the villages. The system of agricultural credit is also defective. The farmer has to depend on the village merchant for loans and there is quite often an undertaking that the farmer will sell his produce to the merchant.

In many areas, keen competition among the buyers makes the village price quite fair and attractive as compared to the prices in *mandis*. It is only in backward areas that the margin of difference is large and the prices ofiered to the farmer are unfavourable as compared with the prices in the *mandi*. Conditions of marketing in the *mandis* are not always very attractive to the small producer. He gets less attention and there are a number of unauthorized deductions. He fails to understand the complicated sale system in the *mandi*. The development of regulated markets and improvements in the marketing facilities may gradually bring a change in the current situation.

Regulated Markets : Most markets in India were unregulated till recently. Once the farmer goes with his produce to the market for any dispute arising between him and the middleman or the purchaser, he has to depend on the decision of his broker and *arhatia*. The facilities for parking carts, drinking water, sanitation etc. are not good. There is considerable room for improvement in market places and sales procedures, system of payment of price, etc.

When the sales are not by the open auction system, the farmer's interest is often ignored. Even in open auctions, there may be a tacit understanding among the bidders not to bid high. For ending these malpractices, marketing committees with strong representation of farmer's interest are necessary. A number of unfair practices like short weights, unwarranted deductions and higher rates of commission and other market charges prevalent in most of the *mandis* take away a substantial share of the price paid by the purchasers and place the farmers at a disadvantage *vis-a-vis* the more organized section of the trading class. The purpose of law and regulation is to

improve competition, to strengthen bargaining power of the producer-seller and this ensures a fair deal to the farmer. During British times, regulated markets came into existence to help exports of industrial raw materials to Britain. But today the regulated markets have to pay a positive role in the orderly development of marketing.

Co-operative Marketing : Co-operative Marketing Societies help the farmer in getting maximum returns for the farm products. Co-operative marketing will strengthen the fibre of village life by making cultivators conscious that what used to be their weakness so far could be converted into strength by pooling their produce and selling it through their own organizations.

State Trading : The latest development is state trading in respect of foodgrains and certain strategic resources. The State can undertake trading activity if it is necessary for building up stocks and for distribution with a certain degree of social control. It may be recommended for a rational system of price stabilization to allow free trade on a competitive basis within certain broad limits and to regulate prices by suitable countervailing measures, overall as well as selective, by public authority.

Internal purchases of foodgrains on behalf of the Government are undertaken by the Food Corporation of India established in 1965.

Place and Time of Sale : Village sales account for the major part of marketed agricultural produce. The Rural Credit Survey found that in 1951 nearly 65 per cent of the total sales were made in the village. This is, however, only an overall position. Marketing studies carried out by the Marketing and Inspection Organization of the Government of India indicate considerable local variations. In Punjab, for instance, 35 per cent of paddy was estimated to have been brought to the assembling markets by cultivators as against only 3 per cent in some parts of Kerala. Direct sale by cultivators in the assembling markets depends on various factors. In some districts of Punjab with well developed means of transport and communication, about four-fifths of the wheat crop is sold by the grower directly in the assembling markets. On the other hand, in other districts of the same State which lack these facilities, the corresponding proportion is insignificant. A similar variation is prevalent among districts in Uttar Pradesh. In western Uttar Pradesh, about one-third of the local surplus is estimated to be taken to the assembling markets by the growers. This proportion is very small in the eastern districts.

In relation to time of sale, the important factor is the preponderance of sale soon after the harvest. Thus, in 1967-68, of the total market arrivals of rice and gram, more than 70 per cent arrived during the two quarters immediately succeeding the harvest. The corresponding figure for wheat was 68 per cent and *jowar* 55 per cent. The rush

of market arrivals in the post-harvest period has increased appreciably, particularly in the case of wheat as a result of the recent Green Revolution. Since these percentages refer to the arrivals in the wholesale markets, they would not fully reflect the extent of post-harvest sales in village markets owing to the carry over of stocks for some period by functionaries between the village and wholesale markets.

Defects in Marketing : The defects in marketing of agricultural produce can be classified into two broad groups. The first group consists of various types of malpractices prevailing in the markets, such as, (1) manipulation of weights and scales against the seller, (2) the practice of taking large quantities as sample, (3) arbitrary deductions from sale proceeds by the market functionaries under various pretexts, (4) sale under cover keeping the seller ignorant of price, and (5) discriminatory marketing charges. The extent of these malpractices varies from market to market and it is difficult to measure it with any precision. Some typical instances of these malpractices may be noted. The *arhatiyas'* commission is usually higher for small cultivators as compared to village merchants who, because of their larger turn-over, get better terms from the *arhatiyas*. This is also true of trade allowance or *karda*. Even in well organized markets like Hapur and Ghaziabad, the cultivators ordinarily pay twice as much as the charges paid by village merchants.

The second group of defects in marketing of agricultural produce arises out of inadequate facilities for transport and storage. This results in simultaneous existence of pockets of scarcities and surpluses leading to wide inter-regional variations in prices.

Regulated Markets : Legislation for regulation of markets was initiated in India in the thirties following the recommendations of the Royal Commission on Agriculture. In that decade, Madras, Central Provinces, Bombay, Mysore and the Punjab enacted the necessary legislation. This process, which was interrupted in the forties because of World War II, gathered momentum during the last decade and legislation for regulation of marketing was enacted in Madhya Bharat, Coorg and Orissa during the First Five Year Plan, and in Bihar and Rajasthan during the Second Plan.

Regulation of markets and market practices is now done under the Agricultural Produce Markets Act. The Directorate of Marketing and Inspection provides the necessary guidance and assistance to States in framing market legislation and its enforcement. Excepting the States of Assam, Kerala, Nagaland, Meghalaya and Jammu and Kashmir, all States have passed laws for market regulation. The total number of regulated markets and market yards at the end of March 1970, was 2,070; this increased to 2,131 by December 1970. During 1971, a study of regulated markets was undertaken to assess the faci-

lities that are needed to cope with the increased arrivals following increased higher production.

Legislation to regulate markets generally covers all the agricultural, horticultural, livestock and livestock products. The Act authorizes the State Government to establish a market committee for every notified area consisting of representatives of cultivators, traders, local bodies, co-operative marketing societies and the Government. The principal aim of the legislation is to ensure fair marketing conditions for cultivators through elimination of malpractices and unauthorized deductions. It stipulates the sale of produce through open auction in the presence of representative of the market committee. It provides for licensing of market functionaries, such as, commission agents with provision for revocation of licence if the market functionary is found to follow unfair practices. It also prescribes that no allowances other than those stipulated in the legislation will be levied. In addition to ensuring fair practices, the market committee heard disputes between buyers and sellers and gives decisions which would be binding on the parties.

Regulation of markets has been helpful in securing reduction in village sales, systematization of methods of sale and weighment and reduction in market charges. There has been a progressive increase in the produce brought to the regulated markets by the growers.

Apart from covering more markets by regulation, it will be necessary to expand facilities by way of market yards and other ancillaries in various markets. A recent study has shown that, in certain areas such as Punjab, during the post-harvest season of 1968-69, market arrivals increased by 150 per cent over the average of corresponding period in the three previous years. The capacity for market yards proved to be inadequate for these large arrivals and considerable market transactions began to be conducted outside the market yards, thus leading to malpractices. In this context, efforts are necessary for strengthening and restructuring the market committees with regard to their resources and functions. A beginning has already been made by some market committees to obtain bank finance for improvement of market facilities. It will be necessary to enable a large number of market committees to resort to such institutional finance and thereby help in the development of market intelligence. Some of the well developed market committees are also expected to make their contribution to the development of feeder roads for which a beginning has been made in a few rural areas. Finally, it will be necessary to evolve a suitable state level machinery for supervising and co-ordinating the work of regulated market committees. Several States are contemplating action to constitute State Agricultural

Marketing Boards on the lines of those functioning in Punjab and Haryana.

Co-operative Marketing : There has been considerable extension and diversification of the activities of the co-operative marketing and processing societies recently. The marketing operations of co-operatives have reached a level of nearly Rs. 600 crores. Co-operatives now account for one-third of the total production of sugar in the country. The value of fertilizers distributed by co-operatives during 1969-70 was of the order of Rs. 232 crores. The total storage capacity available in the co-operative sector is nearly 2.7 million tonnes. To help the farmers, co-operatives in recent years have been branching out into new lines of activities like production of granular fertilizer products, processing and distribution of seeds, manufacture and distribution of improved agricultural implements and setting up of agro-service centres.

The infra-structural activities for processing, storage and marketing of agricultural produce and for supply of agricultural inputs are being further extended to sustain the tempo of agricultural production. Emphasis is continuously being laid on streamlining the structure of co-operative marketing societies and strengthening their administrative machinery so that effective arrangements could be made for collecting the produce from the farmers directly, and selling it at terminal markets. The National and State Marketing Federations have also been directing their efforts towards developing an integrated marketing system in the co-operative sector. Working societies have been evolved with the Food Corporation of India to secure larger participation of co-operatives in the procurement operations of the Corporation for the benefit of the farmers.

The value of agricultural produce marketed by co-operatives was substantial in the state of Maharashtra, Uttar Pradesh, Gujarat and Punjab and these States accounted for about 74 per cent of the total value of agricultural produce marketed by co-operatives in the country during 1969-70.

XI. Labour

Historically, the emergence of a sizeable group deriving its livelihood mainly from casual labour on land is a relatively recent phenomenon in this country. There was perhaps no distinct class of agricultural labourers before the 19th century because the traditional rural community was organized into a balanced agricultural and handicrafts economy. Land was not so scarce and the system of exchange labour took care of additional requirement of labour on particular occasions.

With the rapid increase in population, the pressure on available cultivable land became acute, leading to sub-division and fragmentation of holdings and further to the emergence of people without land depending mainly on labour for livelihood. They had either a very small holding or had no land at all. Simultaneously, the village crafts and cottage industries received a serious set-back, as a result of imports of cheap manufactured articles. A large number of persons lost their traditional occupation and sought refuge in agriculture. They mainly swelled the rank of agricultural labourers. Agricultural labour today occupies the lowest rung of the rural ladder. Social stratification in a village is linked with land and caste which govern status, economic power and political influence as much as the level of living. Owner cultivators with large holdings are at the apex. Agricultural labour is provided mostly by economically and socially backward sections, poor sections from the tribes also swell their ranks.

Labour Population: The decennial Population Census gives information regarding the number of agricultural labourers since 1901, but due to changes in concepts and definitions of census classification, figures for the successive decades are not comparable. According to the 1971 Census, the total number of agricultural workers (cultivators and agricultural labourers) engaged in crop production comes to 126 million, of whom 78.7 million are cultivators and 47.3 million agricultural labourers (Table XX). The corresponding figure for 1961 Census works out to 99.5 million cultivators and 31.5 million agricultural labourers. This implies a decline of over 20 per cent for cultivators and an increase of as much as 50 per cent in the number of agricultural labourers in 1971 over 1961. This indicates that hunger for land among the landless in India is growing. An analysis of the available data shows that in States, such as Andhra Pradesh, Bihar, Tamil Nadu, Uttar Pradesh and West Bengal, the number of landless labourers continues to be high and has grown during the past decade.

Bihar, where 38 per cent of the total working force constitutes landless cultivators, against 23 per cent in 1961, tops all other States in this respect. In Andhra Pradesh, the increase has been from 28.6 to 37.4 per cent, in Tamil Nadu 18.4 to 29.1 per cent, in West Bengal 15.3 to 25.7 per cent and in Uttar Pradesh 11.3 to 19.35 per cent.

On the other hand, Jammu and Kashmir, Nagaland and Himachal Pradesh have a very low population of landless agricultural workers. It is 1.44 per cent of the total working force in Nagaland, 3.12 per cent in Jammu and Kashmir and 4.25 per cent in Himachal Pradesh.

TABLE XX

Total Workers And Agricultural Workers—1971

(Millions)

State/Union Territory	Population	% of rural population to total population	Total workers	% of workers to total population	As cultivators	As agricultural labourers	Total (6+7)	8 as % of (4)
1	2	3	4	5	6	7	8	9
Andhra Pradesh	43.4	80.7	18.1	41.7	5.8	6.8	12.6	69.6
Assam	15.0	91.6	4.3	28.6	2.4	0.4	2.8	65.1
Bihar	56.3	90.0	18.0	32.0	7.6	6.9	14.5	80.6
Gujarat	26.7	71.9	8.4	31.6	3.6	1.9	5.5	65.5
Haryana	10.0	82.2	2.7	26.5	1.3	0.4	1.7	37.0
Himachal Pradesh	3.4	92.9	1.3	36.8	0.9	0.05	1.0	76.9
Jammu and Kashmir	4.6	81.7	1.4	30.0	0.9	0.04	0.9	64.3
Kerala	21.3	83.7	6.2	28.9	1.1	1.9	3.0	51.6
Madhya Pradesh	41.7	83.7	15.6	37.3	8.1	4.1	12.2	78.2
Maharashtra	50.3	68.8	18.7	37.2	6.6	5.4	12.0	64.2
Karnataka	29.3	75.7	10.3	35.2	4.1	2.6	6.7	65.0
Nagaland	0.5	90.1	0.3	52.1	0.2	0.004	0.2	66.7
Orissa	21.9	91.7	6.9	31.6	3.4	1.9	5.3	76.8
Punjab	13.5	76.2	3.9	28.8	1.6	0.8	2.4	61.5
Rajasthan	25.7	82.4	8.3	32.2	5.3	0.7	6.0	72.3
Tamil Nadu	41.1	69.7	15.1	36.7	4.7	4.4	9.1	60.3
Uttar Pradesh	88.4	86.0	28.5	32.2	15.9	5.5	21.4	75.1
West Bengal	44.4	75.4	12.6	28.4	4.0	3.2	7.2	57.1
Union Territories	9.9	52.4	3.3	33.6	1.1	0.3	1.4	42.4
All-India	547.4	80.1	183.4	33.5	78.7	47.3	126.0	68.7

The proportion of land-owner cultivators in these States is among the highest in the country—78.19 per cent of the working force in Nagaland, 71.6 per cent in Himachal Pradesh and 64 per cent in Jammu and Kashmir. This also testifies to their industrial backwardness.

The shift in the proportion of female workers between cultivators and agricultural labourers is particularly striking. Only 28 per cent of such workers have retained their main activity as cultivation and 46 per cent as agricultural labour. A similar trend is observed in almost all the States, except Himachal Pradesh, Nagaland, Manipur and Meghalaya, where the disparity in the female participation rate in cultivation is not so apparent. Even in these areas, excepting Nagaland, the proportion of workers in agricultural labour has shown a definite increase among the females.

The proportion of non-agricultural workers has increased from 30.5 per cent in 1961 to 31.4 per cent in 1971, the increase being accounted for mainly by female workers. The male working population, however, dropped from 35 to 33 per cent due to a larger proportion of workers being claimed by agricultural labourers. In absolute numbers, the non-agricultural male workers have gone up from 35.3 to 48.5 million, an increase of about 7 per cent.

Problem of Identification : Before any other measure relating to the introduction and administration of welfare measures exclusively for agricultural labour could be thought of, the foremost problem was how to identify the agricultural and rural labour amongst the composite setting of rural population. It is common knowledge that the rural population comprises the heterogenous mass of persons who are agricultural and rural labour as well as holders of petty plots or cultivators of small plots on behalf of the rural owners or who augment their income by other avocations like carpentry, smithy, etc. in addition to working as agricultural labour. So it is very difficult to locate agricultural labour as such, if one has to go strictly by the narrow considerations of occupation only, because occupational structure in a village is over-lapping in character. No straightforward formula could thus be evolved which could provide a fool-proof solution to the problem of identification. The casual nature of employment, which keeps them shifting from one farm to another, further adds to the difficulty of identification.

By and large, various authorities concerned have favoured the criterion of income. The problem of definition also engaged the attention of two Agricultural Labour Enquiry Committees. The first Agricultural Labour Enquiry Committee (1950-51) defined agricultural labour as "all those who were engaged as hired labourers in agricultural operations for 50 per cent or more of the total number

of days worked by them during the previous year". The basis of this definition was thus the quantum of hired employment during the period of any year. The second Agricultural Labour Enquiry Committee (1956-57) adopted income as a criterion for demarcating agricultural labour families. A person was deemed to be an agricultural labour if his or her major source of income during the previous year was an agricultural wage.

In these enquiries, a person was considered as an agricultural labourer if he followed anyone or more of the following agricultural operations in the capacity of a labour on hire or on exchange, whether paid in cash, in kind or partly in cash or partly in kind :

(a) farming including cultivation and the tillage of the soils ;
(b) dairy farming ;
(c) production, cultivation, growing and harvesting of any horticultural commodity ;
(d) raising of livestock, bees or poultry ; and
(e) any practice performed on a farm as incidental to or in conjunction with the farm operations (including any forestry or timbering operations) and the preparation for market any delivery to storage or to market or to carriage for tranportation to market of farm products.

The census enumerators defined agricultural labour as a person who works for wages in cash, kind or share (such as share of produce) on another person's land (on which he did not have any right, lease or contract) only as a labour without exercising any supervision or direction in cultivation.

Amongst the parties many have favoured that, in order to have as clearly defined and administratively convenient a programme of welfare amenities for agricultural labour as possible, it is necessary to identify such labour and to definit. As for the definition, a majority of the parties have favoured criterion of income adopted by the Second Agricultural Labour Enquiry Committee for more than one reason. Having examined the question thoroughly, the Committee on Labour Welfare (1969) recommended that agricultural labour be defined as one whose principal means of livelihood is wage income arising out of farm labour and other allied activities. This definition according to them is more rational and scientific because it also includes small and marginal land holders who are no better than agricultural labour.

Character and Problems : Agricultural labour is admittedly not homogeneous in character ; it reveals regional variations dependent on demographic, ecological, technological and other reasons. It is not a distinct type, but is mixed with such occupational categories as share-

croppers, cultivators, construction workers and other unskilled rural labour. Socially, it cuts across peasant groups in a village, though two dominant social groups, *viz.*, scheduled castes and scheduled tribes, have always formed a majority. A point of difference between agricultural workers belonging to scheduled castes and scheduled tribes deserves to be noted. Scheduled castes have been more exposed to the forces of economic and social change through history. Scheduled tribes have been able to preserve in several areas their cohesive and relatively stable socio-agrarian institutions ; a large number of them have settled down as agricultural communities. But in the areas which have recently opened up or been exposed for some time, the socio-economic institutions of both these communities are undergoing changes, some for the better, others not so healthy. Thus the issues connected with agricultural labour acquire an important social dimension.

There cannot be a uni-linear approach for improving conditions of agricultural labour. Remedies lie in bringing about fundamental changes in the agrarian structure and social relationship. Economic growth, and more especially the location of industry in smaller centres and in rural areas, is a recognized remedy, though it is essentially a long-term one. In the meanwhile, sheer population pressure and the numbers involved render any meaningful action difficult.

The problem of agricultural labour, perhaps in the context of agricultural wages or seasonal or disguised unemployment among agricultural labour, was first mentioned by the Royal Commission on Agriculture in 1928. The Commission observed that "the labour problem is, therefore, from the agricultural point of view a simple one to lessen the pressure on land. The essential condition for relieving pressure on land is, therefore, in our opinion, mobility". Despite these observations and the efforts made in industrialization, the pressure of labour on land continued to increase.

Though it would not be correct to say that no attempts were made before independence to improve the living conditions of rural India, it was only after independence that concerted efforts were initiated with the launching of a massive Community Development and Rural Works Programme. The Communiiy Projects Programme, by its very nature had to be a composite one, and it could not isolate agricultural and rural labour from the rest of the population in rural India. Yet the plight of the agricultural labour in the realm of welfare amenities could not be ignored for a long time. It was necessary that, at least, preliminary attempts, to gauge and survey the welfare needs of rural and agricultural labour and their families

in matters like proper housing, hygienic surroundings, medical facilities, recreational amenities and the like, were made.

The 1946 Programme for the amelioration of labour conditions included as its components, fixation of a minimum wage for agricultural workers and a plea for an enquiry into their level of living. The results of the latter were to be used for formulation of measures to protect and improve agricultural wages. The Minimum Wages Act, 1948 was passed ; agriculture was included as one of the employments in the schedule appended to the Act.

Labour Enquiry and the Plans : The first ever attempt to assess the magnitude and problem of agricultural labour was, however, made with the constitution of the Agricultural Labour Enquiry in 1951. This was followed by another Enquiry in 1956-57. The first Enquiry was conducted to provide comprehensive data on essential aspects relating to conditions of agricultural labour, and the second for providing broadly a comparative picture of the conditions of agricultural labour in the country as between 1950-51 and 1956-57.

The findings of the Enquiry gave broad statistical support to the then prevailing notions about the conditions of agricultural labour that it was eking out its existence at the lowest level of incomes, and the primary cause of it was inadequate work and also low payment for whatever work was available. The average per capita income was Rs. 250 in 1950-51; for agricultural labour families, it was Rs. 104. The Enquiry pointed out that labour was employed only to the extent of about half its potentiality to work. Better enforcement of the Minimum Wages Act, 1948, could have been a partial remedy. When various forums during the First Plan discussed the problems of agricultural labour, they pointed out the inadequacy of the action taken in this regard. Economic development in rural areas through promotion of village industries was but only incidentally referred to.

The Second Plan (1956—61) viewed the problems of agricultural labour in the wider perspective of rural development programmes. It recognized the limitations of implementing the minimum wages legislation, but reiterated older remedies. Development and diversification of village industries, redistribution of land, provision of housing facilities, encouragement to labour co-operatives and promotion of scientific agriculture were some of its suggestions. A fresh Agricultural Labour Enquiry (the second ALE) was proposed; its results were expected to provide a firmer base for policies in the Third Plan (1961—66).

When the results of the second ALE (1956-57) were published, it became obvious that because of the changes in the concepts and definitions used, its conclusions could not be compared with those of the first. A detailed technical examination of the two reports by an

Expert Committee set up by the Planning Commission, reached the conclusions *inter alia* (i) the second ALE reflected the conditions of agricultural labour in 1956-57 better than the first ALE did for that category in 1950-51; (ii) no improvement or deterioration in the general conditions of agricultural labour over the period 1950—57 could be established but, (iii) in the light of the increase in per capita income in the country and absence of any marked improvement in the conditions of agricultural labour, an objective of planning in the context of the socialist pattern of society *viz.*, improvement in the levels of living of the lowest category of our working class commensurate with the total development of the economy, was far from being achieved.

The first step towards identification of the problems of agricultural labour including welfare problems was taken in August 1965, when an All-India Seminar on Agricultural Labour was organized by the Central Government. The Seminar adopted, *inter alia*, a number of recommendations relating to welfare of agricultural labour. These were: (i) the importance of allotting housing sites for agricultural labour, if, by mixing this up with rural housing, delays are likely, the farmer should be treated separately as a matter of higher priority; (ii) grant of free-house-sites to the agricultural labour, provision of interest free loans, if possible, or in the alternative concessional finance and cheap credit facilities for building houses should form a separate scheme altogether; (iii) welfare measures relating to drinking water, housing, medical facilities, rest-sheds, etc., as provided for under the Plantations Labour Act and other labour laws should be made applicable to the employers of at least big farms, employing 50 and more workers; (iv) enhancement of the existing provisions for granting stipends and scholarships to the children belonging to agricultural labour families; and (v) other welfare measures for agricultural labour to be considered after undertaking a pilot study to assess the benefits of various welfare measures already being enjoyed by the agricultural labour as part of the overall welfare programmes undertaken in the country for rural population.

Co-ordinating Committee on Agricultural Labour : The next step was to consolidate and co-ordinate the recommendations made by the Agricultural Labour Seminar on a national level. To achieve this, the Union Ministry of Labour, Employment and Rehabilitation established a Co-ordinating Committee on Agricultural Labour. It took a number of important decisions which, *inter alia*, included recommendations for labour welfare measures. It was considered that welfare centres for agricultural labour could be set up in the areas where colonization schemes for resettlement of agricultural labour had been undertaken. A Special Committee was formed to pursue this sugges-

tion further. The Committee also considered that the possibilities of improving the existing arrangements for grant of scholarships to children of agricultural workers should be explored in the light of the recommendations of the All-India Seminar on Agricultural Labour. It decided that a list of such projects where 500 or more workers had been employed as agricultural labour should be compiled and Labour Officers appointed to look after the welfare needs of those workers. The Committee also decided that big farms be identified to find out the possibility of making applicable certain welfare measures relating to drinking water, housing, medical facilities, rest-sheds, as are provided for under the Plantations Labour Act and other labour laws to such farms as employ 50 or more workers. Among the other decisions, that the Committee took, was that a detailed paper on a Rural Housing Scheme, including allotment of house sites and providing interest free loans or concessional finance for construction of houses to agricultural labour should be prepared. It also decided that a pilot study, to assess the benefits of various welfare measures applicable to agricultural workers, should be made. The Committee further suggested that the Director General, Factory Advice Service and Labour Institutes should be approached to study one or two aspects having a bearing on the safety, hygiene etc., of agricultural labour *vis-a-vis* use of pesticides, tractors, etc., on the health of workers.

Improvement in Living Conditions : Besides fixation of minimum wages for agriculture labour, the Third Plan laid emphasis more on provisions of employment than fixation and implementation of minimum wages. It was in this context that a Rural Works Programme was initiated. The programme, which was intended to harness large rural manpower resources for economic development, was to serve as under employment relief. Beginning modestly with the provision of employment for one lakh persons in the first year, the object was to reach a target of 2.5 million persons in the last year of the Plan. Implementation of the programme did not, however, proceed as originally expected and not more than 4 lakh persons could find employment in 1965-66.

The whole programme was then critically examined at a conference in 1965 while laying guidelines for the Fourth Plan. It was recommended that (i) the selection of areas for setting up a programme would be governed by employment considerations, but once the area was chosen, economic considerations should prevail in selection of projects, (ii) the Rural Works Programmes should be an integral part of local area plans in which local institutions should be duly involved and (iii) the administrative and technical organizations involved in the programme should be strengthened. Labour co-opera-

tives, and not professional labour contractors, should be entrusted with the execution of schemes.

In the three years, 1966—69, the programme was maintained more or less at the same level as in the last year of the Third Plan. It is now being proposed to make these programmes a part of the general programme for rural development. The Fourth Plan has thus laid emphasis on labour intensive schemes such as road building, minor irrigation, soil conservation, area development programme, irrigation, flood control and rural electrification. This is expected to enlarge non-farm rural employment and even relieve agricultural under-employment directly by providing employment to agricultural workers.

There are other schemes to assist marginal farmers and agricultural labourers like those of Small Farmers' Development Agencies, Marginal Farmers' and Agricultural Labourers' Scheme, Integrated Dryland Agricultural Development Scheme and Cash Schemes for rural development. Under the Marginal Farmers' Scheme, farmers (with holding upto one hectare) and agricultural labourers (whose wage income from agriculture exceeds 50 per cent) are to be assisted in 41 selected projects during 1970-71. Similarly, Small Farmers' Development Agencies have been created in a number of districts. Increasing support to such activities is likely to help economic development of the small farmers' families of which about 23 lakhs are expected to benefit from this scheme.

About 9,44,000 potentially viable small farmers and 3,01,000 marginal farmers and agricultural labourers have been found eligible for assistance under the Rs. 50 crore crash progamme for rural employment. Of these listed farmers, 2,00,000 small farmers and 27,000 marginal farmers and agricultural labourers have been brought into the co-operative field. Short-term credit worth Rs. 562.39 lakhs was disbursed, besides Rs. 67.08 lakhs on medium-term and Rs. 192.59 lakhs on a long-term basis. The scheme for small and marginal farmers is intended to cover three million families. The Planning Commission has approved 46 projects under the Small Farmers' Development Agency and 42 projects under the Marginal Farmers' Agency.

The Commission is drawing up an integrated land redistribution and rural works programme with a view to removing the disabilities of small farmers and the abject poverty of the landless labour. The scheme, while aiming at redistribution of available cultivable area, will modify the strategy of rural development "to improve the absorptive capacities and productive capabilities of millions of small peasants". It may lay down the following guidelines for a land reform policy to be adopted by the States. No household ownership

holding will be larger than 8.09 hectares, or it may be 6.07 hectares in wet land and 10.11 hectares in dry land.

Non-land owning, non-cultivating households may not receive agricultural land released for redistribution. The land released through fixing a ceiling on holdings is to be distributed among households which have less than 2.02 hectares. If such a land redistribution policy is adopted, the Commission envisages that the difference in per capita land ownership between the smallest and largest household holdings will not be more than five times. The proposed scheme will reduce the number of rural people below the poverty line by about 25 millions. Instead of two-fifth of the rural population now living in abject poverty, this proportion may be reduced to about one-third.

Along with Governmental efforts, another movement being carried on through peaceful and non-violent means by Gandhian workers under the leadership of Acharya Vinoba Bhave aims at distribution of land to the landless. Since its inception in 1951, the movement has developed into an integrated programme and the philosophy of *Sarvodaya* which aims at reconstruction of rural societies and at placing agrarian relations on a more egalitarian basis. This philosophy has important implications for agricultural labour.

Land reforms have two aspects : one relates to the changes in the system of land holding through tenancy reform and abolition of intermediaries, and the other, to the system of land cultivation as affected by ceiling on land holdings, co-operative farming and distribution of land through official agencies or through other movements. Land to the tillers as a cardinal feature of the policy and land reforms have attempted to abolish forced labour which was imposed on small peasants and workers with no land of their own. Like other programmes, agrarian reforms and distribution of land have, however, not been followed up by a policy designed to protect and secure the interest of small peasants and agricultural labour. No tenurial reforms to protect interests of share-croppers have been carried out. The matter is now receiving the urgent attention of the highest authorities.

Among other Plan proposals and programmes that have a bearing on agricultural labour, the following may be specifically stated :

(i) changes in the agrarian structure, including development of co-operative farming and land resettlement programmes ;

(ii) industrial growth, and more specially diffusion of industry into small towns and rural areas ;

(iii) provision of house sites for scheduled castes ;

(iv) effective implementation of minimum wage legislation ;
(v) creation of a special cell within Government for watching closely the progress of development programmes which have a particular bearing on the welfare and development of agricultural workers ; and
(vi) study of special problems which concern them in different parts of the country.

XII. New Strategy And Green Revolution

To the first stage of the new strategy belonged the Intensive Agricultural District Programme (IADP). The Grow More Food Campaign, started as early as 1942, had come in for criticism from all quarters. It was observed that "the movement had failed to arouse widespread enthusiam. This was so because all aspects of rural life are inter-related and that no lasting results can be achieved if individual aspects of it are dealt with in isolation". It was also observed : "The food problem was attacked from the angle of material investments made in land, namely, wells, seeds, fertilizers, etc. Human beings who lived in the villages and cultivated the fields, were practically ignored".

As early as 1928, the Royal Commission on Agriculture had also pointed out that the demand for a better life could be stimulated only by a deliberate and concerted effort to improve the general conditions of the countryside. It was also made clear by it that the responsibility for initiating the steps in the direction lay with the Government.

Intensive Agricultural District Programme : The Intensive Agricultural District Programme, or the Package Programme, as it has popularly come to be known, found its roots in a Report that a team of experts of the Ford Foundation made in 1959. This team, invited by the Government of India, made a survey of India's agricultural problems and suggested practical ways for filling up the gap between food production and consumption. In suggesting an all-out effort in this direction, it outlined specific measures to be taken. The team's recommendation was that selected areas in the country, having the greatest potentialities for rapid foodgrains production, should be chosen for intensive agricultural development.

To exploit fully the production potential of some favourable areas, the Intensive Agricultural Disirict Programme is being worked in selected districts which have the maximum irrigation facilities and minimum natural hazards. It aims at simultaneous provision of all the essential elements needed for increasing the production including credit to all participating cultivators for rapid expansion within a short time.

The programme sponsored during 1960-61, with financial assistance from the Ford Foundation, had the two-fold objective of (a) increasing food production in order to meet the existing shortage as well as to provide a base for more rapid economic development, and (b) demonstrating the most effective ways of increasing food production through concentration of resources, both human and material, and setting a pattern of extending such intensified agricultural programmes to other favourable areas having irrigation or assured water supply. The object was to promote the adoption of a combination of improved practices by the farmers by making available the needed where-withal of production like credit, seeds, fertilizers, pesticides, implements, etc. Each farmer is assisted to develop a crop production plan for his holding.

The programme is currently in operation in 17 districts in the country. The Ford Foundation is rendering technical support to five IADP districts, *viz.* Ludhiana, Thanjavur, West Godavari, Raipur and Sambalpur known as Innovative Districts, in planning, implementing, evaluating, and reporting on the programmes. The Indo-German Agricultural Project, Mandi, which was initially to have been implemented for five years was extended upto March 31, 1971. The Mandi-type project has also been extended to Kangra district from January 1967. For this project, the Government of the Federal Republic of Germany has supplied agricultural machinery, implements, fertilizers, etc., worth about Rs. 17.36 lakhs. A similar intensive agricultural project was undertaken in Nilgiris district of Tamil Nadu from January 1967. Besides services of a number of experts and technicians, the West German Government have provided agricultural machinery, implements, fertilizers, etc., worth about Rs. 12.14 lakhs for this project.

The success of the programme in the modernization of agriculture in the IADP districts is reflected not only in the generation of considerable demand for inputs like improved seeds and fertilizers and for plant protection measures, but also in the rising trend of productivity despite unfavourable weather conditions and occurrence of pests and diseases in endemic form. Among the important programmes introduced under the new strategy are the high yielding varieties programme, multiple cropping programme, and the Ayacut Programme.

The programme was initiated to demonstrate the most effective way of increasing production by the application of scientific know-how and set a pattern for extending such a programme to similar areas having an assured water supply and where conditions are favourable for intensifying efforts.

In the selected districts, an attempt is being made to provide all the essential elements for increasing production to the extent needed such as fertilizers, pesticides, improved seeds, and improved implements ; composite scientific demonstrations are being laid out on a large scale. Credit is being provided on a scale sufficient to reach all farmers including those previously considered not credit worthy.

Through Bench-Mark Survey and systematic evolution, high standards of performance are being insisted upon in these selected districts. The idea is that the districts, chosen for intensive development, should give to the agricultural and other services in each State special opportunities for developing improved methods for extension and for planning of agricultural production at the block and village level as well as in relation to the individual farmers.

While the performance varied a great deal among the different districts, the programme brought into sharp focus two elements of the strategy, namely, the efficacy of the inter-action of various improved agricultural practices conceived as a package and the advantage accruing from concentrated and co-ordinated efforts in areas with significant agricultural potential. From 1964-65 onwards, a similar approach—but with the extension staff on a reduced scale—was introduced in several other parts of the country through the Intensive Agricultural Area Programme which concentrated on specific crops.

Intensive Agricultural Areas Programme : One of the principal lessons of the mid-term appraisal of the Third Plan was the need to give more emphasis on the development of scientific and progressive agriculture in areas where a high agricultural production potential exists. The Agricultural Production Board accordingly agreed in January 1964 to select about 20-25 per cent of the cultivated areas in the country for intensive agricultural development.

This programme also follows the "Package Approach"—the use in agriculture of inter-related factors—physical, social, and institutional—in strategic combinations which are likely to produce an impact on agricultural production. It is also based on the fact that our earlier planning was defective because of our policy of dispersing our resources on too many schemes over too wide an area. A beginning was made in 1963-64. The programme, however, came into operation in March 1964, when field work was taken up.

The normal extension staff has been strengthened in these areas. Attention is also being given to strengthening and streamlining the administrative machinery, delegation of powers to various concerned officers for supporting this programme and provision of credit requirements of agriculturists. Construction of a large network of

rural godowns and supply depots, as an indispensable adjunct of the supply framework, was taken up on a top priority basis.

New Strategy for Agricultural Development : While the IADP and Intensive Development Area Programmes are being continued, the unprecedented drought of the two years 1965-67—and the biological revolution brought about by the introduction of new strains of various foodgrains, helped the country to embark upon a new strategy of agricultural development. The most important of the programmes under the new strategy are the High Yielding Varieties Programme, Multiple Cropping Programme, New Concepts of Irrigation, Ayacut Development and Water Management.

High Yielding Varieties Programme : During the two drought years of 1966 and 1967, when food production fell by 19 per cent, a mood of pessimism spread throughout the country. Few were then aware of the silent revolution which was taking place in the fields of the agricultural universities and research institutes in India.

A new technology of farming was under development using the dwarf and fertilizer-responsive strains of wheat and rice bred in Mexico, Taiwan and Philippines and the high yielding hybrids of maize, Sorghum and pearl millet bred in India.

After two years of rigorous testing, the Mexican wheat varieties, *Lerma* Rojo and *Sonora*-64, were found to be suitable for cultivation in the major wheat growing areas of the country. Similarly, Taichung Native-1, a dwarf rice variety from Taiwan and latter the Philippine variety IR-8 were found to perform very well in several parts of the country. In the case of maize, four high yielding hybrids, *Ganga*-1, *Ganga*-101, *Ranjit* and *Deccan* were released as early as 1961, as a result of the work carried out under the Co-ordinated All-India Maize Improvement Project of the Indian Council of Agricultural Research in collaboration with the Rockefeller Foundation. In Sorghum, the first hybrid CSH-1 was released in 1964, and in Pearl Millet, HB-1, a very high yielding hybrid developed at the Punjab Agricultural University, Ludhiana, was released in 1965.

These high yielding strains provided the raw material for the initiation of a synergistic package of practices under the high yielding varieties programme started by the Government in 1966. A nation-wide Demonstration Programme was initiated in 1965 to introduce farmers to the new vistas in crop yields that were open to them. Because these new strains were capable of giving almost double the yield of earlier varieties when managed properly, they caught quickly the imagination of the farming community and a small developmental programme soon became a mass movement and acquired the popular epithet "Green Revolution".

The exotic varieties introduced under the high yielding varieties programme in its initial stages had several drawbacks. Hence, the first priority in research and developmental efforts had to be placed on the rectification of these defects. For example, the Mexican wheat, *Lerma Rojo* and *Sonora-64* had red grains and hence were not quite acceptable to the farmer and to the consumer. By selection from material sent from Mexico, a whole series of strains possessing fertilizer responsiveness, disease resistance and good grain quality were released in 1967 under the names of *Kalyan Sona*, *Sonalika*, *Chotti Lerma* and *Safed Lerma*.

Also, a variety named *Sharbati Sonora* developed by mutation breeding from *Sonora-64* was released in the same year. Proposals for the release of new high yielding varieties of wheat for commercial cultivation were recently considered at a workshop of all-India wheat research workers. A dwarf variety called *Durum* with good grain and yield potential of five tonnes per hectare has been developed. New high yielding varieties for dry farming have also been developed and some of them have been recommended for release by the workshop.

Similarly in rice, Taichung Native-1 and IR-8 had several drawbacks both with regard to pest and disease susceptibility and grain quality. By crossing the dwarf varieties with Indian rice strains possessing a good quality and pest resistance, a series of new varieties were released by the All-India Co-ordinated Rice Improvement Project under the names *Jaya*, *Padma*, *Jamuna*, *Sabarmati*, *Kanchi*, *Cauvery*, *Bala*, *Ratna*, *Krishna* and *Vijaya*. Further, a dwarf mutant in the popular Orissa rice variety T-141, was released under the name *Jagannath*. These varieties have been recommended for specific areas taking into consideration the duration of the crop that is desirable, the disease problems and the grain qualities liked by the farmers.

Rice production is dominated by the monsoon. On account of the dry climate in which wheat is cultivated there are no pest hazards. Rice, on the other hand, is attacked by many serious pests. Vast areas under rice remain inundated while other areas remain dry and are exposed to moisture stress. There are purely rainfed uplands where rice is grown with a minimum rainfall of 850-1,000 mm. On the other hand, there are areas receiving more than 4,000 mm. of rainfall. Not only does the total rainfall vary from season to season, but its distribution throughout the crop season also fluctuates unpredictably and it is the latter phenomenon which determines the yield variations.

Rice varieties show response to correct time of planting in each region. They complete their growth phase and come to flower at a

particular time of a year, if they are photo-sensitive, or may flower at the end of their growth period, if they are of low sensitivity. Both sets of varieties require adequate quantities of water when they are in flower. Investigations have shown that there is a critical phase in crop growth during which there is no adaptability to moisture stress. Since the major irrigation systems are also dependent upon adequate and timely rainfall in the catchment areas, monsoon will continue to dominate all rice production programmes in India. The future expansion in the area under high yielding varieties depends upon how rice scientists face the problem posed by the monsoon.

Bala and *Padma* evolved at CRRI, maturing in 85 and 105 days respectively under direct seeding, are good upland types. Evolution of upland types has been intensified at the Institute by adopting the latest techniques of breeding and selection procedures, and through an understanding of the physiology of the rice plant under moisture stress.

The next big task of rice scientists is the evolution of varieties which can tolerate about one or two feet of water during the growth stages, survive occasional flooding, and grow efficiently under water-logged conditions. This problem of evolution of suitable high yielding varieties for the *kharif* season involves an understanding of the basic physiology of the plant selection of suitable parents and development of appropriate breeding techniques. Physiologists and breeders at IARI are collaborating in this attempt. Within a few years, it is hoped that suitable varieties will be made available which may permit a dramatic extension of high yielding varieties in the *kharif* season.

High yielding varieties of paddy taken up for cultivation including Taichung Native-1, Taichung-65, Tainan-3, ADT-27, and IR-8 have given quite impressive yields in several areas. It has, however, been found that there have been shortfalls (20 to 30 per cent) in the achievement of targets of the coverage proposed for these varieties during the three seasons (*kharif* 1966 to *kharif* 1968). Amongst the factors responsible for shortfalls, apart from unfavourable seasonal conditions, susceptibility to pest attacks, inadequate plant protection measures, incomplete adoption of package of practices, consumer resistance etc., are quite important.

In Sorghum, the early hybrids, CSH-I and CSH-II had chalky grains and consequently, poor cooking and storage properties. This was due to the use of one parent, a male sterile source from the United States, which had a chalky endosperm. This defect was, however, soon remedied by transferring the male sterile character to Indian varieties and the first hybrid combining high

yielding ability and good grain quality was released in 1970 under the name CSH-III.

In addition, a high yielding variety of Sorghum, *Swarna* has also been released. In millet, three more hybrids HB-II, HB-III and HB-IV, have been released since the time HB-I was made available to farmers in 1965. A major problem in hybrid pearl millet is its susceptibility to diseases like ergot, downy mildew and grain smut. Fortunately, sources of resistance have been found and one hybrid HB.-V, which shows relatively more resistance to ergot was to be released during 1971. In maize, a wide array of hybrids and composites are now available and recently three composites possessing a high lysine content have also been recommended for release.

Thus maize strains suited for child feeding, starch manufacture, unleavened bread making and for processing purposes are now available. Many more strains in all these crops which are being tailored to specific uses are currently in the breeders' assembly line.

Multiple Cropping : Since high yielding varieties are of short duration maturity as compared to traditional varieties, they increase the scope for multiple cropping. Development of irrigation, increased fertilizer use, adoption of water management practices and selection of proper crop rotations can help in raising additional crops both in mono cropped and double cropped areas. Where there is water, four or even five crops can now be grown in a year in multiple, mixed and relay cropping systems, getting for the farmer the benefit of nearly 450 days of crop growth in a year of 365 days. Even the limited work that has been done suggests that improved methods of water conservation and use and enrichment of soil fertility coupled with crop varieties capable of avoiding the rigours of drought or floods through changes in their length of life and co-ordinated pest control schedules, can open up new hopes for peasants working in environmentally handicapped areas. The Green Revolution in cereals has paved the way for developing harmonious systems of agriculture and animal husbandry. Available information from the States indicates that 1.89 million hectares were added to the gross cultivated area in 1969-70 and another 1.51 million hectares might be added during 1970-71 as a result of efforts to increase multiple cropping. To accelerate the tempo of progress of multiple cropping, the Government of India have sanctioned a Centrally sponsored scheme for the organization of Multiple Cropping Projects. Fifty-one pilot projects are proposed to be organized by the end of the Fourth Plan at an estimated cost of Rs. 3 crores. Under these projects, special attention will be given to adaptive research trials, water use and management works programmes, scientific demonstrations and training and audio-visual education. Attention will also

be given to arrangements for provision of credit, input supplies, marketing and other infra-structural aspects. A multi-agency approach involving active participation by all organizations and agencies concerned with agricultural development, such as State Governments, agricultural universities and research institutes, co-operatives, commercial banks and input suppliers, would be adopted under these projects.

Development of Irrigation for Intensive Cultivation : In the development of canal irrigation in the past, one of the main considerations was protection against drought. This meant large coverage with a thin spread of water availability. As a result, many of the areas in the command of canals do not get adequate irrigation water supplies for growing two crops. It was felt that through groundwater exploitation, specially developing tube-well irrigation in the command of irrigation projects, it should be possible to produce two or more crops in such areas. It has also been suggested that the tempo of exploitation of groundwater facilities should be accelerated.

Briefly, the new concept of irrigation implies providing adequate water allowance on new irrigation projects in accordance with the optimum requirements of crops, planning and designing of new irrigation projects for higher irrigation intensities, reducing the command area of State tube-wells and encouraging conjunctive use of surface and groundwater resources. Emphasis was also considered necessary on the development of groundwater on compact area basis providing for construction of tube-wells, installation of pump-sets, land development measures and other complementary inputs in a package form. The programme of groundwater investigations needed to be intensified for the development of groundwater irrigation on a rational basis.

Upto the end of the Third Plan, rural electrification programmes were drawn up with emphasis on the number of villages electrified. Since 1965, when it was decided to give higher priorty to food production, rural electrification has been oriented to agricultural needs primarily and as such irrigation pump-sets and tube-wells are being energized on priority basis. In order to attain this objective, crash programmes were implemented with Central assistance. Against the Third Plan provision of Rs. 105 crores, actual expenditure on such programmes was more than Rs. 153 crores.

During the Fourth Plan period, additional 12.54 lakh tube-wells and pump-sets are likely to be energized, bringing the total figure to well over 23.37 lakhs. On the eve of the First Plan, only around 18,000 tube-wells and pump-sets were electrically operated and the

figures at the end of the Third Plan were in the neighbourhood of 5.13 lakhs.

Ayacut Development refers to water-utilization and management in areas recently brought under irrigation and can also cover areas newly reclaimed by flood control, drainage, and soil conservation measures. It implies planned development of agricultural production in those areas as a composite operation involving adoption of improved agricultural practices, land shaping, construction of channels, supply of inputs, and introduction of new cropping patterns. A water-utilization cell has been formed in the Agriculture Ministry. Special programmes are being undertaken in the Kosi Project, the Cauvery Project, and the Godavari-Krishna delta. A programme of intensive agriculture around tube-wells and other kinds of wells in two districts of Uttar Pradesh is also being undertaken. Assistance available for such projects from international aid-giving agencies such as the World Bank, would be utilized.

Water Use and Management: An important element in the new strategy for agricultural development is the scientific management of irrigation water and its well integrated use with other production inputs and services.

The optimum utilization of water available from irrigation projects involves the study of various factors including soil and climatic conditions and water requirements of various crops at different stages of their growth, in addition to drainage needs, etc. Accordingly, three regional soil and water management pilot projects were initiated in 1968-69 with the technical collaboration of USAID, one each in the Tungabhadra Project (Karnataka), Bhakra Project (Punjab) and Dohrighat Pump Canal Project, Azamgarh (Uttar Pradesh). During 1970-71, four more similar projects were sanctioned in Girna Command (Maharashtra), Kakrapara Command (Gujarat), Mahanadi Delta (Orissa) and Rajasthan Canal (Rajasthan). It was proposed to have one such project in each State during the period of the Fourth Five Year Plan. These projects are designed to demonstrate water management techniques so as to improve utilization of available water resources. Evaluation studies of the existing irrigation projects with a view to improving water use and water management were undertaken in Purnea, Kakrapara and Nizamnagar project areas.

Evalution of sprinkler irrigation in order to find out its economics under Indian conditions for adopting it in the country was undertaken. A study was also undertaken to find the effects of loose sand and sand storms on the functioning of the canal system in the Rajasthan Canal area and to determine remedial steps to avoid silting of the system. On the basis of the findings of this study, afforestation and sand dune stabilization schemes estimated to cost about Rs.

1 crore have been sanctioned. Another study to determine the best cropping patterns and layout and design of land shaping and land levelling in the Tawa Command area is under way. Similar studies are proposed to be taken up in other irrigation projects. Technical literature in the form of bulletins having a bearing on soil survey and land classification, soil-water-plant relationships, lining of channels, irrigation of various crops, irrigation methods, estimating water requirements of various crops, etc., were issued by the Water Management Division of the Department for the use of State Governments, universities, research institutes, cultivators and extension workers.

Evaluation of the Programme: Foodgrains and some of the cash crops like cotton, jute, ground-nut and sugar-cane constitute practically the whole of our agriculture. In so far as the cash crops are concerned, although a number of high yielding and improved varieties have been introduced in the field, there is no impact on their output. Foodgrains occupy nearly three-fourth of the total cultivated as well as irrigated area in the country. High yielding varieties of wheat, rice, *jowar* and *bajra* were introduced during 1967-68 while those of maize have been in the field for a number of years. An analysis of the production of various foodgrains over the last 20 years indicates that while the production of total foodgrains increased at an annual compound rate of 2.98 per cent during 1949-50 to 1970-71, the average annual rate of increase during 1967-68 to 1969-70 is only 2.3 per cent and for the period 1967-68 to 1970-71 around 4.5 per cent.

A detailed study in respect of each of the foodgrains shows that but for wheat there is hardly any spectacular change in the growth rate of other foodgrains. The position in respect of *jowar* and pulses is perhaps the worst, both of which indicate just 17 per cent increase in their respective production levels during the last 21 years. There was, however, remarkable increase in the production of *bajra* and maize in 1970-71, so much so that the Fourth Plan target of 7 million tonnes for *bajra* has been more than achieved and the maize target of 8 million tonnes nearly achieved. But when the position regarding these two cereals is examined closely, it is found that a major part of these increases during the year 1970-71 was due to exceptionally good weather conditions which is difficult to sustain. These increases have taken place in most of the unirrigated States like those of Rajasthan, Gujarat and Uttar Pradesh.

Wheat production has no doubt nearly doubled from an all-time record level of 12.3 million tonnes during 1964-65 to 23.2 million tonnes during 1970-71. This is no small achievement; but even here it is found that of the 40 per cent increase in production during the period 1967-68 to 1970-71, not more than half (20 per cent) was a perma-

TABLE XXI

Actual* Foodgrain Production (1949-50 to 1970-71)

(In million tonnes)

Year	Food grains	Rice	Wheat	Jowar	Bajra	Maize	Ragi	Small millets
1	2	3	4	5	6	7	8	9
1949-50	59.0	25.3	6.8	7.0	3.2	2.9	1.5	1.9
1950-51	53.4	22.2	6.8	6.2	2.7	2.4	1.4	1.7
1951-52	53.8	22.8	6.3	6.7	2.4	2.9	1.2	1.9
1952-53	59.7	24.5	7.6	7.4	3.0	3.5	1.3	1.9
1953-54	70.3	30.0	8.1	8.1	4.3	3.7	1.8	2.5
1954-55	67.9	26.8	9.1	9.2	3.4	3.7	1.7	2.5
1955-56	68.0	28.9	8.9	6.7	3.5	3.2	1.9	2.0
1956-57	71.3	30.4	9.5	7.3	2.9	3.8	1.8	1.9
1957-58	64.4	26.7	8.0	8.6	3.6	3.9	1.8	1.7
1958-59	77.1	32.3	10.0	9.0	3.9	3.9	2.0	2.2
1959-60	75.5	31.9	10.3	8.6	3.5	4.2	2.0	2.0
1960-61	80.9	34.8	11.0	9.8	3.3	4.2	1.9	1.9
1961-62	82.8	36.0	12.1	8.0	3.7	4.4	2.0	2.0
1962-63	78.8	33.5	10.8	9.7	4.0	4.7	2.1	1.8
1963-64	80.6	37.2	9.9	9.2	3.9	4.7	2.0	2.0
1964-65	89.0	39.5	12.3	9.7	4.5	4.8	2.0	2.0
1965-66	71.6	30.7	10.4	7.5	3.7	4.9	1.3	1.8
1966-67	73.1	30.6	11.4	9.2	4.5	5.0	1.6	1.5
1967-68	93.8	37.8	16.5	10.0	5.2	6.4	1.9	1.9
1968-69	93.0	39.8	17.5	9.8	3.8	5.7	1.6	1.8
1969-70	99.5	40.4	20.1	9.7	5.3	5.7	2.1	1.7
1970-71**	107.8	42.4	23.2	8.2	8.0	7.4	2.2	1.9
Compound Growth rate								
1949-50 to 1970-71***	2.87	2.92	5.05	1.82	3.16	4.03		
1949-50 to 1969-70	2.81	2.95	4.59	2.16	2.55	3.81		
1949-50 to 1964-65	2.98	3.37	3.97	2.50	2.23	3.79		
1967-68 to 1969-70	2.98	3.42	10.22	(—)1.64	1.38	(—)6.01		
1967-68 to 1970-71	4.97	3.71	12.31	(—)6.03	17.82	4.35		
1964-65 to 1970-71	3.56	1.43	—	—	—	—		

*Adjusted with 1969-70 production as base.

**Figures for 1970-71 are the final estimates for the year.

***1965-66 and 1966-67 figures are adjusted.

TABLE XXII

Total Foodgrains : Area and Production

States	Area ('000 hectares)			Production ('000 tonnes)		
	1969-70	1970-71	(3)—(2)	1969-70	1970-71	(6)—(5)
1	2	3	4	5	6	7
Andhra Pradesh	9,438	9,180	(—) 256	7,399	6,897	(—) 512
Assam	2,382	2,142	(—) 240	2,119	2,194	(+) 75
Bihar	9,926	9,774	(—) 152	7,546	8,146	(+) 600
Gujarat	4,948	5,102	(+) 154	3,221	4,406	(+) 1,185
Haryana	3,831	3,835	(+) 4	4,567	4,732	(+) 165
Himachal Pradesh	827	789	(—) 38	982	967	(—) 15
Jammu and Kashmir	803	809	(+) 6	1,151	1,081	(—) 70
Kerala	928	926	(—) 2	1,243	1,294	(+) 51
Madhya Pradesh	16,534	16,709	(+) 175	9,769	10,696	(+) 927
Maharashtra	13,594	13,025	(—) 571	6,914	5,590	(—) 1,324
Karnataka	7,878	7,188	(—) 690	5,891	5,962	(+) 71
Nagaland	60	67	(+) 7	50	50	0
Orissa	5,748	5,918	(+) 170	5,033	5,151	(+) 118
Punjab	3,907	3,839	(—) 68	6,937	7,024	(+) 87
Rajasthan	11,371	12,836	(+)1,465	4,750	8,813	(+) 4,063
Tamil Nadu	5,163	5,240	(+) 77	6,239	7,024	(+) 785
Uttar Pradesh	19,428	19,664	(+) 236	17,547	19,483	(+) 1,936
West Bengal	6,137	6,148	(+) 11	7,363	7,418	(+) 55
All-India	123,570	123,870	(+) 300	99,501	107,811	(+) 8,310

nent change and has resulted from increases in per hectare yields. Of the remaining 50 per cent increase in production, as much as 30 per cent was at the cost of non-remunerative but much more important grains like gram, *rabi* pulses and oil-seeds etc. The remaining 20 per cent was the result of an increase in the area during 1970-71 over 1969-70 purely because of seasonal factors.

All this would indicate that the things as they stand, India has no doubt the wherewithal for sustaining the wheat revolution. With the rapid progress of rural electrification in eastern U.P. and Bihar, a major part of the northern wheat zone will be covered by high yielding varieties and it can be safely assumed that these regions which at present produce not more than half of the Punjab yields might also be able to catch up particularly in the irrigated areas. But as far as other crops are concerned, the results achieved so far do not indicate any significant improvement in production levels.

Attempts now being made to evolve varieties much superior to those already in the field can be expected to materialize in the coming few years. Again, as a result of thousands of new tube-wells that were installed primarily to aid the cultivation of high yielding wheat, many districts now have the supplementary irrigation needed to grow paddy, which is now emerging as a major monsoon crop in the wheat zone. In addition, the increased efficacy of pest control, water management, fertilizer application and drainage systems in the major paddy zones themselves are finally leading to a steady rise in the level of output per hectare.

XIII. Crops

The cropping pattern of Indian agriculture is determined mainly by natural factors like rainfall and soil conditions. Technical factors like irrigation, improved varieties of seeds and the use of fertilizers effected the pattern only marginally till recently. With the introduction of the high yielding varieties, there has been some shift in the area under crops like wheat (Table XXIII). Market prices, no doubt, also cause marginal shifts in the land area devoted to different crops, but their overall effect is not pronounced.

For some individual crops like wheat, high yielding varieties have replaced old and inferior varieties in a major part of the irrigated area. Although the impact of the green revolution has not been evenly spread, wherever it has made itself felt, it has led to a new pattern in which farmers move in a continuous cycle from one new variety to another and from straight-forward cropping systems to those that are more complex. Multiple cropping is again the latest

TABLE XXIII

Shift in the Area under Wheat 1964-65 to 1970-71

State	Changes area 1970-71 over 1967-68				Changes area 1967-68 over 1964-65			
	Wheat	*Gram and Barley*	*Tur, Linseed and other Rabi pulses*	*Rape and Mustard*	*Wheat*	*Gram and Barley*	*Tur, Linseed and other Rabi pulses*	*Rape and Mustard*
1	2	3	4	5	6	7	8	9
Bihar	(+) 176	(—) 216	(+) 190	—	(+) 417	(—) 114	(—) 502	(—) 7
Haryana	(+) 272	(—) 309	(—) 3	(—) 115	(+) 124	(+) 60	—	(+) 78
Madhya Pradesh	(+) 667	(—) 83	(—) 97	(+) 44	(—) 497	(+) 214	(—) 340	(—) 24
Punjab	(+) 396	(—) 299	(—) 12	(—) 51	(+) 241	(—) 92	(—) 21	(+) 48
Rajasthan	(+) 206	(+) 152	(+) 32	(+) 53	(+) 82	(+) 171	(—) 35	(—) 10
Uttar Pradesh	(+) 893	(—) 408	(—) 124	(+) 136	(+)1,005	(—) 252	(—) 164	(+) 242
West Bengal	(+) 241	—	—	—	(+) 38	—	—	—
Total of above	(+)2,851	(—)1,442	(+) 180	(+) 66	(+)1,410	(—) 13	(—)1,052	(+) 327
All-India	(+)2,894	(—)1,225	(+) 244	(+) 87	(+)1,576	(+) 80	(—)1,118	(+) 334

trend in advancing agriculture. To grow more than one crop on the same land in the same year so that a variety of produce could be had from the land is the principle behind this new move. In a way, multiple cropping is the logical sequence of the high yielding varieties programme introduced in 1967-68. The innovative spirit of the individual farmers was exploited for introducing new crop varieties which were more prolific than the traditional ones and demand more attention from the farmer.

There are at the same time crops like indigo which have more or less disappeared as a result of the supply of synthetic substitutes. Among oil-seeds, ground-nut has made fairly good progress.

Foodgrains continue to predominate in the overall cropping pattern. In regard to the major crops (Table XXIV), the share of total foodgrains has gone up from 80 per cent in 1950-51 to 81.8 per cent in 1970-71. Among the foodgrains, cereals accounted for 66.9 per cent of the area during 1970-71 and pulses for the remaining 14.9 per cent. The share of the area under pulses has actually declined while that of foodgrains has increased during the 20 years of post-independence period from 1950-51 to 1970-71.

Rice is the staple food of a substantial section of the Indian population. Area under the crop has increased from 31 million hectares during 1950-51 to 37.4 million hectares in 1970-71. The impact of the introduction of high yielding varieties of rice has not been marked so far. The area under the crop during 1970-71 was 24.7 per cent of the cropped area as against 24.3 per cent during 1960-61. The next important crop from the consumer's point of view is wheat which improved its position substantially so as to occupy as much as 11.8 per cent of the area during 1970-71 as against 9.4 per cent during 1960-61 and 8.9 per cent during 1950-51. *Jowar* has now been relegated to the third position with 11.5 per cent of the area from 12.4 per cent during 1960-61. From among the other coarse grains, while *bajra* has maintained its share, maize has improved its position from 2.6 per cent during 1950-51 to 3.8 per cent in 1970-71. As against this, small millets and barley have lost much ground. Different coarse grains are grown in different regions but the cultivation af *jowar* and *bajra* is more widespread.

The principal non-food crops are cotton, jute, ground-nut and sugar-cane. Cotton, with 7.3 million hectares during 1970-71, shared only 4.8 per cent of the cropped area as against 5.4 per cent during 1950-51. Oil-seeds as a whole, constituting 10.1 per cent of the area were being grown on 15.3 million hectares during 1970-71. Nearly half of this area was occupied by ground-nut alone. Jute in which

TABLE XXIV

Distribution of Gross Sown Area Among Different Crops in India

Commodities	*1950-51 Area (Million hectares)*	*Percentage to the total*	*1960-61 Area (Million hectares)*	*Percentage to the total*	*1970-71 Area (Million hectares)*	*Percentage to the total*
1	2	3	4	5	6	7
Cereals						
1. Rice	31.0	23.6	33.5	24.3	37.4	24.7
2. *Jowar*	15.5	11.8	17.3	12.4	17.4	11.5
3. *Bajra*	10.3	8.1	11.4	8.2	12.9	8.5
4. Maize	3.2	2.6	4.4	3.2	5.8	3.8
5. *Ragi*	2.2	1.5	2.3	1.7	2.5	1.7
6. Small millets	5.6	4.7	4.8	3.4	4.8	3.2
7. Wheat	10.8	8.9	13.0	9.4	17.9	11.8
8. Barley	3.2	2,4	3.2	2.3	2.6	1.7
Total cereals	81.9	63.6	90.0	64.9	101.4	66.9
Pulses						
9. Gram	7.9	5.9	9.4	6.8	7.8	5.3
10. *Tur*	2.2	1.5	2.4	1.7	2.6	1.7
11. Pulses other than gram and *tur*	11.0	9.0	11.4	8.2	12.0	7.9
Total pulses	21.2	16.4	23.1	16.7	22.4	14.9
Total foodgrains	103.1	80.0	113.1	81.5	123.9	81.8
12. Sugar-cane	1.7	1.3	2.3	1.8	2.6	1.7
Oil-seeds						
13. Ground-nut	4.9	3.4	6.3	4.5	7.3	4.8
14. Castor-seed	0.6	0.5	0.4	0.3	0.4	0.3
15. Sesamum	2.0	1.5	2.2	1.5	2.4	1.6
Other oil-seeds	4.9	3.4	4.6	3.4	5.2	3.4
Total oil-seeds	12.3	8.8	13.5	9.7	15.3	10.1
Fibres						
16. Cotton	6.0	5.4	7.6	5.5	7.3	4.8
17. Jute	0.6	0.4	0.6	0.4	0.8	0.5
Other Non-food Crops						
18. Tobacco	0.4	0.3	0.4	0.3	0.4	0.3
19. Black pepper, dry chillies and ginger	1.6	1.2	0.7	0.5	0.8	0.5
20. Potato, fruits and vegetables	2.7	2.6	0.4	0.3	0.4	0.3
Total	128.4	100.0	138.7	100.0	151.5	100.0

India had a world monopoly before partition occupies just 0.5 per cent of the cropped area.

Among vegetables, potato has a place of pride and along with other vegetables has accounted for 0.3 per cent of the area. Plantation crops like tea, rubber and coffee, some dry fruits like cashew-nuts and spices like black pepper are highly valued crops. Bulk of them is being exported to earn the much needed foreign exchange. But they occupy a very small proportion of the land under cultivation.

Regional Distribution : Data on crop areas are available according to the administrative divisions of the country although crop zones in many cases cut across them (Table XXV). For instance, rice is grown in coastal areas with heavy and assured rainfall, both in the eastern and the western States. Regions which have ample supply of irrigation water also grow rice and they are located in most of the States. Important rice growing States are Andhra Pradesh, Bihar, Madhya Pradesh, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal. Recently water-logged areas in Punjab and Haryana have also come under rice. Here rice is of the nature of a cash crop and this northern region has now emerged as an exporter of rice on a large scale.

Wheat is generally grown in black loamy soil in the *rabi* season as a winter crop. The October rain or supply of rain water is necessary for its growth. The central and northern parts of the country grow wheat in large areas, although it is primarily restricted to Haryana, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh. The crop is also grown in parts of Bihar in the east and Gujarat and Maharashtra in the west. Wheat is now being introduced on a sufficiently large scale in West Bengal where the area under the crop during 1970-71 was as much as 320 thousand hectares.

Coarse grains are grown in Western India and the interior regions of the southern tract. Important *bajra* growing States are Rajasthan and Gujarat. Maharashtra also grows *jowar* but *bajra* is relatively more extensively grown in this State.

Cotton is an important crop in wheat and coarse grains zones and alternates with wheat, *jowar* and *bajra*. Important cotton growing States are Gujarat, Maharashtra, Karnataka and Punjab. Madhya Pradesh, parts of Tamil Nadu and Andhra Pradesh are also quite important but superior quality cotton is restricted to Punjab, Gujarat, Tamil Nadu, and Andhra Pradesh.

Jute is being cultivated primarily in the eastern region where there is heavy rainfall. While West Bengal accounts for nearly half of the area under jute, Bihar and Assam are also quite important

TABLE XXV

Area, Production and Yield of Foodgrains—1970-71

Area (A) : 000' hectares
Production (P) : 000' tonnes
Yield (Y) : Kg. per hectares

Crops		States													
		Andhra Pradesh	*Assam*	*Meghalaya*	*Bihar*	*Gujarat*	*Haryana*	*Himachal Pradesh*	*Jammu and Kashmir*	*Kerala*	*Madhya Pradesh*	*Maharashtra*	*Karnataka*	*Nagaland*	*Orissa*
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Rice	A	3,396	2,001	99	5 232	489	267	105	222	875	4.334	1,356	1,160	67	4,566
		(9.1)	(5.3)	(0.3)	(14.1)	(1.3)	(0.7)	(0.3)	(0.6)	(2.3)	(11.6)	(3.6)	(3.1)	(0.2)	(12.3)
	P	4,650	2,016	114	4,539	598	450	124	397	1,271	3,647	1,663	1,953	74	4,383
		(11.0)	(4.8)	(0.3)	(10.8)	(1.4)	(1.1)	(0.3)	(0.9)	(3.0)	(8.6)	(3.9)	(4.6)	(0.2)	(10.3)
	Y	1,369	1,008	1,152	868	1,223	1,685	1,181	1,788	1,453	842	1,227	1,684	1,109	960
		(121)	(89)	(102)	(77)	(108)	(149)	(104)	(158)	(128)	(74)	(108)	(149)	(97)	(85)
2. Wheat	A	17	21	0.3	1,230	577	1,118	289	210	—	3,328	882	305	—	14
		(0.1)	(0.1)	(0.02)	(6.9)	(3.2)	(6.2)	(1.6)	(1.2)	—	(18.6)	(4.9)	(1.8)	—	(0.1)
		4	12	0.2	1,192	939	2,340	268	250	—	2,528	451	95	—	20
	P	(0.02)	(0.05)	(0.01)	(5.1)	(4.0)	(10.1)	(1.2)	(1.1)	—	(10.9)	(1.9)	(0.4)	—	(0.1)
		235	585	667	969	1,627	2,093	927	1,191	—	760	511	310	—	1,429
	Y	(18)	(44)	(61)	(75)	(125)	(161)	(71)	(92)	—	(59)	(39)	(24)	—	(110)
3. Coarse cereals	A	4,381	—	—	1,648	3,613	1,306	344	322	—	4,992	8,193	4,591	—	437
		(9.5)	—	—	(3.6)	(7.8)	(2.8)	(0 7)	(0.7)	—	(10.8)	(17.8)	(10 0)	—	(0.9)
	P	1,990	—	—	1,489	2,703	1,128	551	395	—	2,632	2,701	3,512	—	280
		(6.5)	—	—	(4.9)	(8.8)	(3.7)	(1.8)	(1.3)	—	(8.6)	(8.8)	(11.5)	—	(0.9)
	Y	454	—	—	904	748	864	1,602	1,227	—	527	330	765	—	641
		(69)	—	—	(137)	(113)	(131)	(242)	(185)	—	(180)	(50)	(116)	—	(97)
4. Pulses	A	1,113	79	1.2	1,266	284	89	44	52	34	1,994	1,482	663	—	828
		(9.3)	(0.7)	(0.01)	(10.6)	(2.4)	(0.7)	(0.4)	(0.4)	(0.3)	(16.7)	(12.4)	(5.5)	—	(6.9)
	P	159	28	0.7	617	81	36	15	38	13	669	373	189	—	428
		(3.5)	(0.6)	(0.2)	(13.7)	(1.8)	(0.8)	(0.3)	(0 8)	(0.3)	(14.9)	(8 3)	(4.2)	—	(9.5)
	Y	143	354	583	487	285	405	341	731	382	336	252	285	—	517
		(38)	(94)	(155)	(130)	(76)	(108)	(191)	(195)	(102)	(90)	(67)	(76)	—	(138)

Figures relate to pulses other than *Tur*

(*Contd. next page*)

TABLE XXV (Contd.)

Area, Production and Yield of Foodgrains—1970-71

Crops		States							All-India
		Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal	Manipur	Tripura	
1		16	17	18	19	20	21	22	23
1. Rice	A	389	119	2,686	4,553	4,949	140	269	37,432
		(1.0)	(0.5)	(7,2)	(12,3)	(13.3)	(0.4)	(0.7)	(100)
	P	671	135	5,303	3,729	6,105	184	243	42,448
		(1.6)	(0.3)	(12.6)	(8.8)	(14.5)	(0.4)	(0.6)	(100.0)
	Y	1,725	1,126	1,974	819	1,238	1,316	900	1,134
		(152)	(100)	(174)	(72)	(109)	(116)	(80)	(100)
2. Wheat	A	2,200	1,471	1.3	5,863	320	—		17,892
		(12.3)	(8.3)	(0.1)	(52.8)	(1.8)	—	—	(100.0)
	P	4,875	1,945	0.5	7,541	700	—	—	23,247
		(17.5)	(8.4)	(62.02	(32.4)	(3.0)	—	—	(100.0)
	Y	2,215	1,322	385	1,286	2,188	—	—	1,299
		(171)	(102)	(30)	(99)	(168)	—	—	(100)
3. Coarse cereals	A	840	7,667	2,090	5,465	140	—	—	46,121
		(1.8)	(16.6)	(4.5)	(11.8)	(0.3)	—	—	(100.0)
	P	1,169	4,984	1,610	5,110	116	—	—	30,540
		(3.8)	(16.3)	(5.3)	(16.7)	(0.4)	—	—	(100.0)
	Y	1,392	650	770	935	829	—	—	662
		(210)	(98)	(116)	(141)	(125)	—	—	(100)
4. Pulses	A	54	1,952	408	1,078	540	—	0.6	11,966
		(0.5)	(16.3)	(3 4)	(9.0)	(4.5)	—	(0.005)	(100.0)
	P	25	552	89	834	340	—	0.2	4,488
		(0.6)	(12.3)	(2.0)	(18.6)	(7.6)	—	(0.004)	(100.0)
	Y	463	283	218	774	630	—	333	375
		(123)	(75)	(58)	(206)	(168)	—	(189)	(100)

Note : Figures in bracket represent per cent of All-India for area and yield as Index with All-India equal to 100.

in this respect; Orissa and Uttar Pradesh are developing this crop now.

Oil-seeds are being cultivated in the coarse grains zones along with or in places of cotton. As for ground-nut the most predominant States are Gujarat, Andhra Pradesh, Tamil Nadu, Maharashtra and Karnataka. More than one-third of the total area under ground-nut is occupied by Gujarat and Maharashtra and another one-third by the three southern States of Andhra Pradesh, Tamil Nadu and Karnataka.

The traditional sugar-cane growing regions are Uttar Pradesh and Bihar. More than 50 per cent of the area under the crop is in Uttar Pradesh. The second position in the area as well as production of sugar-cane is now occupied by Maharashtra. Bihar has now been relegated to the third position in the total area under the crop. Other important sugar-cane growing States are Haryana, Andhra Pradesh, Punjab and Tamil Nadu.

Tobacco is grown in Andhra Pradesh, Gujarat and parts of Karnataka. The superior quality of virginia tobacco is, however, found only in the southern States of Andhra Pradesh and Karnataka. Gujarat tobacco is used primarily for *bidi*, *hookah* and snuff manufacturing. Tea gardens are located at high altitudes in mountainous areas in the southern and north-eastern regions.

Crop Production and Yields : In spite of big strides made in the past few years under the high yielding varieties programme land productivity in India is still low. This in a way indicates a sizeable potential for increasing production. On the other hand, it also indicates the amount of efforts in terms of investment that would be required to achieve internationally comparable levels. The vast gap in unit yields of various crops is apparent from the comparable data for other countries.

Wheat : The production of wheat in the country had nearly doubled between 1966-67 to 1970-71. Average yields also increased from 851 kg. per hectare during 1960-61 to 1,229 kg. per hectare in 1970-71 (Table XXVI). In certain selected States like Haryana, Punjab and West Bengal, the average yield is more than 60 per cent higher than the all-India level. A district like Ludhiana in Punjab today is producing above 30 quintals per hectare against the Punjab average of 22.2 quintals per hectare.

Nearly 50 per cent of the total production of wheat in the country is being produced in Uttar Pradesh and Punjab. Uttar Pradesh alone accounts for one-third of the total production. But yield levels in Uttar Pradesh are just the same as those obtainable at the all-India level. There is thus a huge potential for increasing the production of wheat in the country. There are quite a number of other new high

TABLE XXVI

Area Under Production and Yield Of Different Foodgrains

Area : 000' hectares
Production : 000' tonnes
Yield : Kg. per hectare

Crop	Year	Area	Production	Yield	Index with 1950-51=100			Share in total foodgrains	
					Area	Production	Yield	Area	Production
1. Rice	1950-51	30,810	20,576	668	100	100	100	31.66	40.49
	1960-61	34,128	34,574	1,013	111	168	152	29.53	42.15
	1970-71	37,432	42,448	1,134	121	206	170	30.22	39.38
2. Wheat	1950-51	9,746	6,462	663	100	100	100	10.00	12.72
	1960-61	12,927	10,997	851	133	170	128	11.18	13.41
	1970-71	17,892	23,247	1,299	184	360	196	14.44	21.56
3. Barley	1950-51	3,113	2,378	764	100	100	100	3.20	4.68
	1960-61	3,205	2,819	879	103	119	115	2.78	3.44
	1970-71	2,597	2,865	1,103	83	121	144	2.10	2.65
4. *Jowar*	1950-51	15,571	5,495	353	100	100	100	16.00	10.80
	1960-61	18,412	9,814	533	118	179	151	15.93	11.96
	1970-71	17,436	8,188	470	112	149	133	14 08	7.60
5. Maize	1950-51	3,159	1,729	547	100	100	100	3.25	3.40
	1960-61	4,407	4,080	926	140	236	169	3.82	4.97
	1970-71	5,829	7,413	1,270	185	429	232	4.72	6.87
6. Other cereals	1950-51	15,831	5,774	365	100	100	100	16.26	11.36
	1960-61	18,939	7,022	371	120	127	102	16.38	8.57
	1970 71	20,252	12,074	596	128	209	163	16.34	11.20
7. Pulses	1950-51	19,091	8,411	441	100	100	100	19.63	16.55
	1960-61	23,563	12,704	539	123	151	122	20.38	15.50
	1970-71	22,424	11,576	516	118	138	117	18.10	10.74
8. Total food-grains	1950-51	97,321	50,825	522	100	100	100	100.00	100.00
	1960-61	115,581	82,018	710	119	161	136	100.00	100.00
	1970-71	123,870	107,811	870	127	212	167	100.00	100.00

yielding varieties like Triple-Geni Dwarf, *Heera*, *Moti*, HD-1925 and HD-1977 which are superior to well accepted varieties like *Kalyan-Sona*. These varieties not only give higher yields but also do not lodge at higher dose of nitrogen.

Rice : There is not much improvement in the production or yield levels of rice as wheat. With 1950-51 as base, the index of rice production increased to 168 during 1960-61 and 205 during 1970-71. Corresponding figures for yield are 152 and 170 as against 128 and 196 for wheat. Against the all-India average yield of 1,134 kg. per hectare during 1970-71, yields in Tamil Nadu were 74 per cent higher and those of Punjab, Karnataka, Jammu and Kashmir and Haryana around 50 per cent higher. Andhra Pradesh and Tamil Nadu alone account for nearly one-fourth of the total production of rice in the country. Another one-third, is shared by the eastern States of Assam, Meghalaya, Bihar, West Bengal, Manipur and Tripura.

The new high yielding varieties of rice already evolved have failed to usher in the green revolution for rice. Rice is a *kharif* crop which is raised mainly when the sky is cloudy and enough sun is thus not available. Field studies have indicated that a proven high yielding variety like IR-8 has performed better in Punjab when raised as a *rabi* crop than in the heavy monsoon areas like Orissa and West Bengal where paddy cultivation takes place during the *kharif* season.

Research is still going on to evolve some better varieties to respond to the local requirements in different parts of the country. Latest field trials indicate that IR-20 has proved more successful than IR-8 on several counts. Not only does it give an additional yield of 2 tonnes per hectare, it has also better grain quality and has a broad spectrum of disease resistance. Similarly, two other promising fine grain rice varieties—*Sabarmati* and *Jamuna* have been evolved.

Pulses : Pulses have actually suffered as a result of the green revolution. Unfortunately, the foodgrains which imbibed the benefits of the new technology were making inroads on the area under pulses in recent years; and to some extent the area under oil-seeds too, which are another major source of protein. The fact that cereals and pulses are mutually substitutable can aggravate the shortage of pulses and oil-seeds in particular years. Mustard, *mung*, *urad*, linseed, gram and peas are also interchangeable with wheat in different parts of the country. When the demand for cereals goes up and the relative net price differential is favourable, the farmer is tempted to prefer wheat instead of the less remunerative pulses crop. That this has happened frequently and extensively is indicated by the figures.

The index number of area for wheat (base-1949-50 : 100) rose to 163.5 in 1968-69, the figure for maize to 174.1 and for rice to 120.4.

For pulses it was only 106.7. For gram, however, it actually dropped to 85.7. *Tur* has fared better than gram, having moved up to 108.1, which, in relation to the major cereals, is low. All the other pulses together approximated to 120, which is just short of the point reached by rice.

Recently some new varieties of pulses like *mung* have been evolved. *Mung* G-65, for example, which matures in 65 days and contains 28 per cent protein has yielded nearly 20 quintals per hectare at the research farm. Since pulses can be sandwitched between the wheat and the main *kharif* crops like rice and maize, there is a possibility of an increase in the area under them several fold without effecting the area under other crops. Similarly, the Rajasthan Agriculture University has evolved a new variety of *urad*—*Krishna* which matures in 90 days and has 22 per cent protein content. This has given 30 per cent higher yield as compared to the local variety. With a new emphasis now placed on the importance of pulses, the Union Government has sent detailed instructions to the States to formulate action programme to increase the production of pulses.

The strategy envisages the adoption of a package approach in large areas under irrigation and assured rainfall where rapid returns could be obtained with the available improved varieties. This could particularly be achieved in respect of *arhar*, gram and pea crops which have a capacity to yield about 2.5 tonne per hectare. It is proposed to cover an area of 8.52 million hectares which will yield an additional 1.43 million tonnes.

Coarse Grains : Although the production of coarse grains like *jowar*, *bajra*, maize, barley, etc. has not made much progress, they together constitute nearly 30 per cent of the total production of foodgrains in the country. The share of *jowar* has been reduced from over 10 per cent during 1950-51 to 7.6 per cent during 1970-71. Production of maize and *bajra* has, no doubt, shown a tremendous increase during 1970-71 but this has primarily been due to exceptional weather conditions (Tables XXVII & XXVIII). Otherwise in spite of the introduction of high yielding varieties of *jowar*, *bajra* and maize, much progress does not seem to have been made in their production.

Rajasthan and Uttar Pradesh produce nearly one-third of the total coarse grains in the country. Gujarat, Madhya Pradesh, Maharashtra and Karnataka produced another 38 per cent of the coarse grains during 1970-71 and the balance was shared by the remaining States. In States like Punjab, coarse grains are being substituted by superior grains such as wheat and rice.

TABLE XXVII

Area, Production and Physical Change Under Maize in Important States

Area : '000 hectares
Production : '000 tonnes

State	Area		(3)—(2)	Production		(6)—(5)
	1969-70	1970-71		1969-70	1970-71	
1	2	3	4	5	6	7
Bihar	953.3	980.7	(+) 27.4	865.6	1,071.8	(+) 206.2
Madhya Pradesh	623.3	590.0	(—) 33.3	417.7	633.8	(+) 216.1
Punjab	562.9	572.0	(+) 9.1	826.8	867.0	(+) 40.2
Rajasthan	782.9	757.4	(—) 25.5	518.0	928.4	(+) 410.4
Uttar Pradesh	1,505.3	1,496 9	(—) 8.4	1,192.2	1,768.9	(+) 576.7
Others	1,434.5	1,441.7	(+) 7.2	1,854.0	2,143.0	(+) 289.0
All-India	5,862.2	5,838.7	(—) 23 5	5,674.3	7,412.9	(+) 1,738.6

TABLE XXVIII

Area, Production and Physical Change Under *Bajra* in Important States

Area : '000 hectares
Production : '000 tonnes

States	Area		(3)—(2)	Production		(6)—(5)
	1969-70	1970-71		1969-70	1970-71	
1	2	3	4	5	6	7
Andhra Pradesh	601.9	534.0	(—) 17.9	320.0	291.1	(—) 29.9
Gujarat	1,784.2	1,782.1	(—) 2.1	1,204.4	1,574.9	(+) 370.5
Haryana	928.0	879.0	(—) 49.0	516.0	822.0	(+) 306.0
Maharashtra	2,257.2	1,928.5	(—) 328.7	762.9	787.7	(+) 24.8
Karnataka	566.7	510.0	(—) 56.7	226.6	263.5	(+) 36.9
Rajasthan	4,346.4	5,126.9	(+) 780.5	807.8	2,673.6	(+) 1,865.8
Uttar Pradesh	1,020.2	1,111.0	(+) 90.8	752.7	861.3	(+) 108.6
Others	988.2	1,035.9	(+) 47.7	736.4	727.1	(—) 9.3
All-India	12,492.8	12,907.4	(+) 414.6	5,326.8	8,000.2	(+) 2,673.4

Cash Crops : Important cash crops in the context of Indian agriculture are cotton, jute, oil-seeds and sugar-cane (Tables XXIX & XXX). Of late, there has been stagnation in the production of cash crops, particularly cotton and jute, in respect of which the peak levels were reached in 1967-68 and have never since been surpassed despite various package programmes initiated by the Centre. Cotton production in 1970-71 was just 4.6 million bales as against 5.7 million bales during 1964-65 and per hectare yield has come down from 122 kg. to 108 kg. during this period. More or less same is the position of jute where the production came down from 6.3 million bales during 1967-68 to 4.9 million bales during 1970-71. The present yield is only 1,177 kg. per hectare as against 1,293 kg. in 1967-68. The production of ground-nut at 6.1 million tonnes is just a shade higher than the 1964-65 level and same is with regard to yield in spite of the fact that the current year was the best with regard to natural factors. The production as well as yield of sugar-cane is also lower than the levels achieved during the last few years.

Cotton : The important cotton growing States in the country are Gujarat (34.5 per cent), Punjab (18.1 per cent), Maharashtra (10.6 per cent) and Haryana, Maharashtra and Tamil Nadu (over 7.5 per cent each). Although India occupies nearly 25 per cent of the world area under cotton, the yields are the lowest as compared to those in the major cotton growing countries like the U.S.S.R. and the U.S.A. With a view to boosting the production of cotton and doing away with the country's long dependence on imports, Government has approved a three-year programme costing Rs. 14.74 crores. This programme would popularize the use of improved seeds of new varieties, application of recommended doses of fertilizers and adoption of plant protection measures. Six districts have been selected in the irrigated zone : Ferozepore and Bhatinda in Punjab, Hissar in Haryana, Ganganagar in Rajasthan, Baroda in Gujarat and Coimbatore in Tamil Nadu. It is proposed to cover a total of 5.6 lakh hectares on cotton cultivated area in these districts. Demonstrations of farm holdings in these areas show that cotton production can be stepped up by 40 to 100 per cent.

In non-irrigated areas, it is proposed to initiate a programme on a pilot basis in approximately 140,000 hectares spread over seven districts in different States. These are Kurnool in Andhra Pradesh, Surendranagar in Gujarat, Khargon in Madhya Pradesh, Akola and Yeotmal in Maharashtra, Dharwar in Karnataka and Tirunelveli in Tamil Nadu. Baroda and Surendranagar account for about 30 per cent of the total area under cotton crop and about 35 per cent of the total production of cotton in Gujarat. The per hectare yield in

these districts, which has gone up by about 50 per cent over the three plan periods reached 202.5 kg. in the Baroda and 136 kg. in the Surendranagar districts in 1965-66.

The irrigated areas for cotton are spread over some 55 districts of the country. More than half of the areas are located in a few sizeable blocks in Punjab, Rajasthan, Haryana, Gujarat and Tamil Nadu. The areas are not only compact, but also offer potential for raising yield levels.

Jute : More than 50 per cent of the jute production in the country comes from West Bengal alone and another 36 per cent from Assam and Bihar. Orissa produces 6 per cent followed by 2 per cent in Uttar Pradesh and 1 per cent in Meghalaya. In spite of the development schemes for jute, average yields have remained stagnant over the last many years. The development programmes for jute have, therefore, been accelerated and are likely to get a further boost through much larger outlays in the remaining period of the Fourth Five-Year Plan. The Government has also set up an Action Group to formulate an intensive jute development programme.

Oil Seeds : India had been the world's premier supplier of vegetable oils and fat some 30 years back. Now it is unable to meet even the needs of internal consumption. In the early sixties the per capita availability of 4kg. compared very unfavourably with the world average of 10 kg, and the optimum nutritional needs of 20 kg. The availability has since declined further. In the planning decades, the output of oil-seeds has increased at an annual rate of 2.2 per cent. The growth in the sixties had declined to mere 0.32 per cent a year. With the growth in population of 2.5 per cent a year, it is inevitable that per head availability should decline and find reflection in continually rising prices.

In order to achieve a breakthrough in raising the production of ground-nut by extending intensive cultivation programmes to large areas, a Centrally sponsored scheme was first implemented in three States. In 1971-72, the target had been fixed to cover 2.25 million hectares covering 17 States. A subsidy of 25 per cent, on plant protection chemicals besides the entire cost of addititional staff is being met by the Union Government. This entails financial assistance to the tune of Rs. 101.71 lakhs.

Recently, two short duration and high yielding varieties of castor *Aruna* and CCH 3 have been evolved. The demonstration was first organized in 1969-70 and was continued during 1970-71. Encouraged by the performance of these new varieties, it is proposed to experiment on an area of 1,721 hectares in 14 States. A sum of

TAELE XXIX

Area, Production and Yield of Important Cash Crops

Area : 000' hectares

Production : 000' tonnes

Yield : Kg. per hectare

Crop	Year	Area	Production	Yield	Index with 1950-51=100		
					Area	Production	Yield
1	2	3	4	5	6	7	8
1. Cotton	1950-51	5,882	2,875	88	100	100	100
	1960-61	7,610	5,293	125	129	184	142
	1970-71	7,610	4,556	108	129	158	123
2. Jute	1950-51	571	3,309	1,043	100	100	100
	1960-61	629	4,134	1,183	110	125	113
	1970-71	750	4,905	1,178	131	148	113
3. Sugar-cane	1950-51	1,707	5,705	3,343	100	100	100
	1960-61	2,415	11,141	4,613	142	195	138
	1970-71	2,657	13,194	4,966	156	231	149
4. Ground-nut	1950-51	4,494	3,481	775	100	100	100
	1960-61	6,463	4,812	745	144	138	96
	1970-71	7,293	6,065	835	162	174	108
5. Other Oil-seeds (excld. ground-nut)	1950-51	6,233	1,677	269	100	100	100
	1960-61	7,307	2,170	297	117	129	110
	1970-71	8,053	3,123	388	129	186	144
6. Total	1950-51	18,887	17,047	903	100	100	100
	1960-61	24,424	27,550	1,128	129	162	125
	1970-71	26,363	31,843	1,208	140	187	134

TABLE XXX

Area, Production and Yield Under Cotton, Jute, Ground-nut and Sugar-cane

All-India

Year	Cotton			Jute			Ground-nut			Sugar-cane		
	Area million hectares	Production million bales	Yield per hectare in kg.	Area million hectares	Production million bales	Yield per hectare in kg.	Area million hectares	Production million tonnes	Yield per hectare in kg.	Area million hectares	Production million tonnes	Yield per hectare 000 kg.
1	2	3	4	5	6	7	8	9	10	11	12	13
1964-65	8.4	5.7	122	0.8	6.1	1292	7.4	6.0	814	2.6	121.9	46.8
1967-68	8.0	5.5	123	0.9	6.3	1293	7.6	5.7	759	2.0	85.5	46.7
1968-69	7.6	5.1	122	0.5	2.9	1002	7.1	4.6	653	2.5	124.7	49.2
1969-70	7.7	5.3	122	0.8	5.7	1327	7.1	5.1	720	2.7	135.0	49.1
1970-71	7.6	4.6	108	0.8	4.9	1177	7.3	6.1	832	2.7	128.8	48.5

Rs. 125 per hectare for rain-fed crop and Rs. 200 per hectare for irrigated crop will be provided.

In order to increase the production of castor, a Centrally sponsored scheme was introduced in 1970-71 in Andhra Pradesh, which has the largest area under the crop in the country. The coverage of the target for 1971-72 for the package programme was 40,000 hectares for *kharif* and 6,000 hectares in *rabi*. Production of pure seed and demonstration was to be taken up during 1971-72 at an estimated cost of Rs. 1.50 lakhs. Similarly, a scheme to increase the production of rape-seed and mustard-seed has been envisaged at a cost of Rs. 9 lakhs.

Apart from arranging demonstrations for the production of soyabean at a cost of Rs. 3.03 lakhs, a Centrally sponsored scheme has been drawn to bring four lakh hectares of land under this crop.

Sugar-cane : The production of sugar-cane in terms of *gur* fell from 12.8 million tonnes in 1965-66 to 9.5 million tonnes in the following year. Since then, production progressively rose to 13.4 million tonnes in 1969-70, but in 1970-71 it again declined to 12.3 million tonnes. Of the total production in the country, Uttar Pradesh alone accounts for 42.2 per cent, although yield in the State is just 82 per cent of the all-India average. Highest yields come from Karnataka, Tamil Nadu and Maharashtra which account for 6.4, 8.7 and 12.7 per cent respectively of the total production.

XIV. Population and Food Supply

According to the 1971 Census, the population of India is 547.4 millions, which accounts for 15 per cent of the world's population. She has, on the other hand, only 2.4 per cent of the world's land area with low levels productively. This would explain the crux of the problem of population and food supply.

In the last 70 years, every succeeding decade has ended up, by and large, with a higher net growth rate of population compared to the previous one. So much so, the total population stood more than doubled during the last 70 years. The last decade (1961-71) witnessed the pheonomenal growth of 24.66 per cent. At a compound rate of growth of 2.5 per cent this is not very much different from the one experienced in the last decade. India's population will be doubled by the end of the present century.

This rapid growth of an already very large population poses a serious challenge to India's agriculture. It has not only to feed these growing numbers but also to provide raw materials for the country's growing agro-based industries and, particularly for those which enable it to earn the much needed foreign exchange for carrying through other developmental programmes in the country.

Since independence food production has expanded rapidly ; but the rate of increase in demand for foodgrains generated as a result of increase in population and rising income has outstripped the rate of increase in foodgrains' production. During 1950-51 to 1970-71 the country had imported 64 million tonnes of cereals.

Although the index of food production with 1950-51 as base, has gone up to 182·7 during 1970-71 against a population index of 152.7, the food supply position is not quite easy in respect of all types of foodgrains. Even otherwise, population index as compared to the food production index stood higher right upto 1966-67. Food imports were the lowest during 1955-56 at 1.4 million tonnes and increased steadily to reach the highest peak level of 10.4 million tonnes during 1965-66 (Table XXXI). Thereafter, as a result of increase in production, imports have been on the decline. At one time it had even been announced by the Government that all concessional imports of foodgrains would come to an end after 1971. Since Indian agriculture is susceptible to weather conditions, there will always be fluctuations in production. As a result, the country did face a series of bad seasons like between 1965 and 1967.

Besides providing adequate food and proper clothing as the basic necessity for the people, Indian agriculture also provides the means of livelihood for practically the whole of the rural population. Since foodgrains occupy as much as 75 per cent of the cultivated land and employ perhaps 72 per cent of its agricultural labour force for its production, higher levels of food production constitute an important aspect of agricultural development programmes. The Five-Year Plans have placed a good deal of emphasis on this aspect. Available data on foodgrains' production since 1951 show that nearly half of the increase is due to extension in area and the other half due to increase in productivity. Ever since the introduction of high yielding varieties during 1966-67, there have been sharp increases in the production with hopes of abundance in the near future. Wheat production has, no doubt, more or less doubled but the same is not the case with regard to other foodgrains. The annual growth rate for the period 1967-68 to 1970-71 has been negative for *jowar*, minor cereals and pulses (Table XXXII). The Fourth Plan target of 7 million tonnes for *bajra* was over-achieved during 1970-71 and that for maize was near the target. The position

TABLE XXXI

Population and Food Supply

Year	Population (Mid-Year)		Production of Foodgrains		Imports	Net Availability		Per Capita Availability	
	Million	Index	Actual (million tonnes)	Index Agricultural Year 1949-50=100	Cereals million tonnes)	Cereals (million) tonnes)	Pulses (tonnes)	Cereals (gram per day)	Pulses
1	2	3	4	5	6	7	8	9	10
1950-51	363.35	100.0	50.8	90.5	4.8	44.3	8.0	334.1	60.9
1955-56	397.49	109.4	66.9	115.3	1.4	52.4	10.3	360.4	70.5
1960-61*	442.65	121.8	82.0	137.1	3.5	64.4	11.2	398.8	69.0
1961-62	452.79	124.6	82.7	140.3	3.6	66.3	10.3	400.7	62.3
1962-63	463.16	127.5	80.2	133.6	4.6	64 8	10.1	382.4	59.5
1963-64	473.77	130.4	80.6	136.5	6.3	69.3	8.8	398.3	50.6
1664-65	484.62	133.4	89.4	150.8	7.5	73.7	10.9	414.7	61.6
1965-66	495.72	136.4	72.3	121.3	10.4	64.8	8.7	355.9	47.6
1966-67	507.07	139.6	74.2	123.8	8.7	66.6	7.3	356.8	39.1
1967-68	518.68	142.7	95.1	159.0	5.7	76.1	10.6	397.0	55.1
1968-69	530.56	146.0	94.0	157.5	3.9	76.6	9.1	390.8	46.4
1969-70	542.71	149.4	99.5	168.6	3.6	79.2	10.2	394.3	50.8
1970-71*	555.02	152.7	107.8	182.7					

*Population figures for the years 1960-61 to 1970-71 have been calculated at an annual compound growth rate of 2.29 as calculated from the actual population figures for 1960-61 and 1970-71.

TABLE XXXII

All-India Production of Different Crops

('000 Metric Tonnes)

Crop	*1967-68*	*1988-69*	*1969-70*	*1970-71*	*Annual growth rate from 1967-68 to 1970-71 (%)*	*Target 1973-74*
1	2	3	4	5	6	7
1. Rice	37,612	39,761	40,430	42,448	4.30	52,000
2. Wheat	16,540	18,651	20,093	23,247	13.52	24,000
3. Maize	6,270	5,701	5,674	7,413	6.08	8,000
4. *Bajra*	5,185	3,802	5,327	8,000	18.10	7,000
5. *Jowar*	10,048	9,804	9,721	8,188	(—) 3.52	
6. Other cereals	7,295	5,876	6,565	6,954	(—) 1.56	23,000
7. Pulses	12,102	10,418	11,691	11,576	(—) 2.40	15,000
8. Total foodgrains	95,052	94,013	99,501	107,811	4.36	129,000

about rice which is the most important food crop of India is not that satisfactory. In eastern, central and southern India rice is the staple food and if it is available in plenty, the people would consume it in preference to other foodgrains. Consequently, there is always a pressure on rice stocks. Planning for food production has to take into consideration this important aspect.

The future food problem in a nutshell will, therefore, be of a restrictive nature in the sense that it would involve a specific emphasis on the production of rice and pulses. With regard to rice, varieties have to be evolved suitable for the different agro-climatic zones. As regards pulses, the position is a little complicated. The area under cultivation is about 17 per cent of the total cultivated land in the country and yet the highest production level so far achieved has not exceeded 12 million tonnes in the best year. The position remained more or less unchanged during first three Plan periods. Little attention was paid to the development of pulse cultivation and no serious efforts were made to overcome the limiting factors. Since most of the pulses are grown on unirrigated lands, they have invariably depended on the vagaries of the monsoon. Again, with the introduction of the high yielding varieties, foodgrains which imbibed the benefits of new technology, have made inroads on the area under pulses.

Recently some efforts have been made by research workers and there are some possibilities for increasing the yield of pulses particularly during the *kharif* season through control of pests. In *kharif moong* alone, the yield could almost be doubled through pest control measures.

Self-Sufficiency : The objective of self-sufficiency in foodgrains as the goal to be reached through increased foodgrains' production was first announced early in 1949. The deficit to be made up by the end of March 1952, was at that time calculated at 4.9 million tonnes over the level of production in 1947-48 on the basis of the then prevailing level of consumption. The target for additional production of foodgrains was, therefore, fixed at 4.9 million tonnes. Production targets for foodgrains under the First and Second Five-Year Plans were drawn up with a view to reducing the large gap between internal production and consumption requirements, the deficits proposed to be made up being 7.7 million tonnes and 10.2 million tonnes during the five-year periods 1951-56 and 1956-61, respectively. The Second Plan target of additional production of 10.2 million tonnes of foodgrains was revised to 15.7 million tonnes after the publication of the Plan. The objective of self-sufficiency was reiterated either explicitly or implicitly while fixing the Third Plan and the original Fourth Plan (1966-71)

targets of 102 and 132 million tonnes to be attained by 1965-66 and 1970-71, respectively. The revised Fourth Plan (1969-74) target of 129 million tonnes of foodgrains' output to be attained in 1973-74 provided (though this is not explicitly stated) for the requirements for addition to buffer stocks and pipelines stocks and some exports too.

Among the reasons for continued deficits in foodgrains despite increased production, one could put an unrealistic estimation of demand also. For example, the deficit of 4.9 million tonnes estimated under the 1949 plan of self-sufficiency was based on the projected net requirements for the 1952 population at the same per capita availbility as in 1947-48 from internal production as well as from imports. The implied assumption was that the entire additional qualities produced would be available for consumption and not even the usual allowance for seed, feed and wastage was made. The First Plan target of foodgrains production too was based on a stable level of per capita consumption as in 1949-50. Under the Second Plan, for the first time, increase in per capita consumption, taking into account the increased incomes generated by the Plan, was allowed for. However, the population estimates originally contemplated went wide off the mark and thus even the revised target of 82 million tonnes, which was actually achieved, did not meet the internal requirements fully. Foodgrains production in the last year of the Third Plan, *viz.* 1965-66, was adversely affected by severe drought and consequently it slumped to 72 million tonnes whereas in the previous year, *viz.*, 1964-65, output reached the record level of 89.4 million tonnes. Again, during the years 1967-68 and 1968-69 although the production levels reached were 95.1 and 94.0 million tonnes respectively, these were considerably below the targets envisaged under the original Fourth Plan (1966-71). In consequence, India continued to import cereals despite the emphasis given to the food production programmes in the successive Plans.

Nutritional Requirements : With self-sufficiency as defined in the previous section, it may be assumed that the country has reached a level of near self-sufficiency in cereals, particularly when all concessional imports are to be stopped and Government stocks at over 9 million tonnes as at present are the highest on record. The problem, however, remains with regard to the provision of a nutritively balanced diet to the people. According to the recommendations of Nutritional Advisory Committee, the foodgrains requirement in a balanced diet of an adult male in India is 397 grams of cereals and 85 grams of pulses per day. The balanced diet includes several items of what are known as protective foods such as milk, meat, eggs, etc. Since these protective foods are not being produced, at

present, in quantities adequate for balanced diet, a large majority of the people have to make up for these deficiencies by additional consumption of cereals. This would call for a further addition to the quantities of cereals recommended by the Nutritional Advisory Committee.

It has been estimated that the daily per capita requirements of the Indian population for a reasonably satisfactory level of nutrition would be 2,100 calories of energy and 61 grams of proteins per day. As against this, the per capita, per day availability of cereals and proteins as at present are of the order of 2,000 calories and 48 grams respectively. The average Indian diet today contains only 5.6 grams of animal protein which constitutes only 9.1 per cent of the necessary protein intake. In affluent societies, nearly half of the protein intake is in the form of animal protein. Allowing for wastage of food between availability at the retail level and the cooking, the minimum nutritional target for the country may be placed at 2,370 calories and 66.6 grams of protein, including 10 grams of animal protein per day per adult. Dr. P.V. Sukhatme has worked out the least cost combination of major food groups needed per head per day on the basis of this minimum level. The quantities so worked out along with quantities currently available are given in the Table below. According to Sukhatme, one in every four of India's people appears to be underfed and two out of every four are malnourished.

TABLE XXXIII

Per Capita Quantities of Major Food Items Available and Needed to Meet Minimum Nutritional Target

	Quantity per day (gm.)	
Item	*Available*	*Needed*
Cereals	394	403
Pulses and nuts	51	104
Starchy roots	39	46
Sugar	44	50
Fruits and vegetables	58	137
Meat	4	7
Fish	1	17
Eggs	3	2
Milk and milk products	116	201
Fats and oils	9	18

This indicates the deficiencies in regard to each item of the minimum nutritive diet. The deficiencies are particularly large in respect of pulses and protective food items like fruits and vegetables, milk, meat and eggs. If these deficiencies are to be made good concurrently with the requirements of additions to the population, agricultural production, including that of poultry and animal husbandry will need to be substantially stepped up. Efforts now being made to meet this challenge are special programmes for the development of poultry, piggery, livestock and horticulture etc. Although the progress with regard to livestock development is not very encouraging, poultry and piggery development can be expected to develop much faster particularly when maize and other coarse grains are available in quantities at reasonable prices. With regard to horticulture, States like Himachal Pradesh have had a real break-through. The area under apple cultivation, for example, has progressively increased from 1,214 hectares in 1956 to 42,700 hectares in 1971. The Government is now pursuing a Rs. 45 crore World Bank project to boost fruit cultivation and production. Processing and marketing is being pursued by the Government. A cold storage, the largest of its kind in India, is nearly complete at Delhi.

A 15-year horticulture development plan has been drawn up under which one-third of the total cultivable area of Himachal Pradesh will be brought under horticulture at the rate of 8,094 hectares per year. An Agricultural Refinance Corporation for financing the planting of apple orchards by individuals is also being set up.

Consumption and Purchasing Power : The actual consumption by an individual or a family or a section of the population depends not so much on average availability but its purchasing power. A detailed study of one region (Maharashtra) revealed that in the year of the study (1958), only when the total monthly expenditure reached Rs. 13 to 18 per person, the dietary intake amounted to 2,170 calories with proteins intake of 60.4 grams of which only 2.9 grams consisted of animal proteins. In the region concerned, 60 per cent of the people lived on income level below Rs. 18 per head per month. This emphasizes the need not only of producing more food but also producing it at costs which should preferably be lower than the prevailing.

The problem of food and nutrition focussed attention of the Planning Commission for the first time in the Fourth Five-Year Plan which attempted to set out an integrated nutrition programme. Some of the measures recommended by the Plan are :

(a) Improvement of staple foods.
(b) Production of unconventional protein foods.
(c) Nutrition education.
(d) Special measures for vulnerable groups.

The outlays on nutrition programmes in the various sectors are as follows :

TABLE XXXIV

Outlay on Nutrition

Sl. No.	*Department*	*Central sector*	*States sector*	*Total*
1.	Health and Family Planning	5.13	—	5.13
2.	Community Development	13.90	2.10	16.00
3.	Food	13.05	—	13.05
4.	Education	—	5.00	5.00
5.	Social Welfare	6.00	—	6.00
6.	Total	38.08	7.10	45.18

Recently under the high yielding varieties programme new seeds being evolved contain more of protein or lysine content. In the case of wheat and rice the total available protein content has been increased. The recently released varieties of *Shakti* and *Rattan* maize are said to be almost as good as milk. Because of the high lysine content, maize has high quality protein. Feeding tests conducted with the new varieties of maize have shown that children fed on them become as strong as those fed on milk.

XV. Animal Husbandry and Dairying

Cattle in India pose a difficult problem at a time when the economy is rapidly growing and agriculture is required to play a leading role. Mixed farming in India enabled products of land to be fully utilized for both human and animal feed. This situation is now slowly changing. Finer rice and wheat for which demand is rapidly rising are poor yielders of fodder. On the other hand, milk consumption is below nutritional level and with increasing income and population the total demand for milk tends to rise. The religious traditions discourage cattle slaughter. Weeding of cattle is, therefore, done by nature through malnutrition which is indiscriminate in its impact. This keeps down quality without adequately controlling the number. Without mechanization and rural transportation, the farmer depends on bullocks and the use of cattle as a source of draft power and supply of organic manure still dominates. With expanding irrigation and double cropping, there is an increasing pressure on demand for cattle for which the present cattle population, despite its

large number is ill-equipped. A beginning has been made under the Five-Year Plans to improve systematically the quality of cattle with the long-term objective of increasing output of cattle products with proportionately less feeding costs.

Livestock Population : The total livestock population in India consisting of cattle, buffaloes and other small animals like goats, sheep, etc., was 343.8 millions according to the Livestock Census for the year 1966 Table XXXV. The bulk of the livestock consists of cattle and buffaloes, which together accounted for 67 per cent of the total. Numerically, the livestock population in India, judged on the basis of cattle and buffaloes only, is one of the largest in the world. According to 1951 data, India had about one-fifth of the world's total cattle population and one-half of the total buffalo population. Though cattle in India were then three times more than buffaloes, India was probably the world's most important buffalo-rearing country. Indian cattle and buffalo population accounted for over 68.5 per cent of the total number in the Asian continent.

TABLE XXXV

Livestock Population : 1945—1966

(In thousands)

	1945	1951	1956	1961	1966
Cattle	135,960	155,099 (155,238)	158,651	175,557	176,057
Buffaloes	40,593	43,351 (43,401)	44,916	51,211	52,920
Sheep	37,729	38,829 (38,962)	39,246	40,223	42,014
Goats	46,286	47,077 (47,115)	55,405	60,864	64,566
Horses and ponies	1,399	1,514 (1,514)	1,483	1,327	1,149
Mules	45	60	40	53	75
Donkeys	1,132	1,239 (1,249)	1,055	1,096	1,054
Camels	654	629	776	903	1,028
Pigs	3,707	4,420 (4,424)	4,932	5,172	4,975
Others				22	30
Total livestock	267,505	292,218 (293,595)	306,504	336,428	343,868

Note : Figures in brackets are comparable in coverage with those of subsequent Livestock Census.

Looked from another angle, India carried in 1951 nearly 35.1 per cent more cattle and buffaloes than Europe including U.S.S.R., or about 21.7 per cent less than that in vastness of the cattle and buffalo population when we consider that India has a substantial proportion of population which does not eat meat and also the fact

that the geographical area of India is much smaller than the continents of Europe or America. This inevitably puts a heavy pressure on India's limited land recources. Countries like Denmark have a larger density of cattle and buffalo per sqaure km. than India and countries like New Zealand, Argentina and Australia have a larger ratio of cattle population to human population.

The total livestock population increased by about 28.5 per cent during the 20 years from 1950-51 onwards. During 1950-51 to 1955-56 the increase is more spectacular in the case of work animals *e.g.* mules (41.6%), camels (13.9%) and goats (16.1%). Male buffaloes have increased by 6.6 per cent while the female buffaloes have increased by 4.5 per cent only. The cattle population has increased only marginally.

Male cattle are useful for work in the field or for transport while male buffaloes are used mainly for breeding, except in a few States where they are used for work. Consequently, the number of male cattle is larger than that of cows, but in the case of buffaloes females outnumber males. Again, the ratio of young-stock to cattle is relatively higher than that of young-stock to total buffaloes. This would imply larger waste of young-stock of cattle, probably caused by religious inhibition against killing cows.

Livestock in Rural and Urban Areas : Livestock population is proportionately much larger in rural areas, since the occupation of animal husbandry is largely combined with cultivation of land. However, owing to inadequate transport facilities for carrying fresh milk over long distances, a part of the livestock population is located in towns and cities. Besides, in cities, horses are used for drawing carriages and bullocks for carts for local transport of goods. In 1956, of the total livestock of 306.5 millions in the country, 11.9 millions or about 4 per cent were in cities and towns, the rest were in rural areas.

Nearly 6 per cent of the total poultry birds are maintained in urban areas. In 1956, out of total 94.7 million poultry birds in the country 5.5 million birds were in urban areas.

Work Animals : Ploughing of land in India is done traditionally with the help of bullocks. Cows are rarely used, since it is supposed to affect adversely their milking capacity. Buffalo males are slow and inactive. They have, however, a capacity to withstand wet weather. For this reason, they are employed for cultivation of land in high rainfall areas and for load carrying, especially for

carrying water. The statistical details of the work animals in India during the decade 1956-66 are given in the following Table.

TABLE XXXVI

Work Animals

	(In thousands)		
	1956	*1961*	*1966*
Cattle			
Working males	62,475	68,704	69,177
Males used for breeding and work both		1,964	2,255
Working females	1,837	2,150	1,983
Buffaloes			
Working males	5,953	6,645	6,972
Males used for breeding and work both		493	620
Working females	420	487	386
Horses and ponies	1,482	1,327	1,148
Mules	40	52	75
Donkeys	1,054	1,096	1,054
Camels	775	903	1,028

Dairy Animals: Bovine animals—cows and buffaloes and to a small extent, sheep and goats—are used for milking. According to the 1966 Livestock Census, there were 20.97 million cows and 12.92 million buffaloes in milk in India. Animals in milk increased by about 18 per cent during 1945-61 but the increase over the next 5 years was only marginal—1.05 per cent for cows and 3.7 per cent for buffaloes. Human population during this period increased at a faster rate. But as the increase in cattle led to increased pressure on fodder supply, the increase in the number of dry cattle was faster. The proportion of dry and wet calved cows increased from 53.6 per cent

in 1945 to 55.7 per cent in 1961 and over 61 per cent in 1966. The percentage of dry buffaloes increased even faster—from 42.9 to 46.5 during 1945-61 and over 47 per cent during 1966. The problem of dry cattle has thus become more serious.

A cow yields on an average 187 kg. of milk per year during the lactation period. A buffalo yields a much larger quantity—499 kg. per year—of milk with a higher fat content. Substitution of cows by buffaloes for increasing milk supply is economical and this process has already begun. Weather conditions and availability of grazing land determine the proportion of cows and buffaloes in different regions. Even in the same State, buffaloes predominate in some districts and cows in others. In Uttar Pradesh, Andhra Pradesh, Madhya Pradesh, Gujarat and Maharashtra buffaloes are relatively more numerous. In Bihar, West Bengal, Tamil Nadu and other States the proportion of cows is larger.

Slaughter Stock : Beef eating among Hindus is prohibited by religion. Hence the demand for beef is low and it fetches relatively low price, with the result that mostly unserviceable cattle are slaughtered. Buffalo meat being coarse and disagreeable to the general taste of meat-eaters, the demand is low.

Distribution among States : Uttar Pradesh with 14.5 per cent of cattle and 21.8 per cent of buffaloes is at the top. With regard to cows and bullocks, Madhya Pradesh comes a close second with 14.3 per cent. Its position is fourth in respect of buffalo population. The second position with regard to buffallo goes to Andhra Pradesh. Maharashtra comes third with regard to the population of both cows and buffaloes. Rajasthan has 7.6 per cent of both cows and buffaloes. Punjab, while it possesses 8.5 per cent of buffaloes (males over three years being quite insignificant), has only 3.7 per cent of cows and bullocks, between cows and bullocks the latter predominate.

Variations in the number of cattle from State to State are due to climate, grazing facilities, and the area under fodder crops which determine to a great extent the quality of cattle and the carrying capacity of land. Agricultural development, introduction of irrigagation, reclamation of land, etc., affect adversely the livestock as the land available for grazing is reduced and the cultivated area under fodder and feed crops does not go up correspondingly, resulting in the reduction of total livestock feed. Both from the viewpoint of quality and number, important states for livestocks are Rajasthan, Punjab, Uttar Pradesh, Madhya Pradesh and Andhra Pradesh.

As regards other animals, nearly 60 per cent of sheep are almost equally distributed in the three States of Rajasthan, Andhra Pradesh and Tamil Nadu. A little more than 50 per cent of the goats are found in Rajasthan, Maharashtra, Bihar and Uttar Pradesh, 65 per

cent of horses and ponies are in Uttar Pradesh, Madhya Pradesh and Maharashtra. Mules are mainly in Uttar Pradesh and Punjab, camels in Rajasthan and Punjab and donkeys in Uttar Pradesh, Rajasthan and Maharashtra.

Breeds and Breeding : One of the reasons for the low quality of cattle is unsatisfactory supply of breeding bulls. A bull with average health conditions can service 60 cows in a year. The number of cows per breeding bull was 77 in 1951 and increased to 119 in 1961. Regarding buffaloes, the situation was only slightly better ; number of buffaloes per bull was 70 in 1951 and 59 in 1961.

There are only 25 well defined breeds of cattle and these are found only in certain parts of the country. These breeds account for less than 20 per cent of total cattle. The pure breeds are mostly indigenous and are preserved by communities of cattle-breeders known as *ahirs, rabaris,* etc. The traditional cattle-breeders are now facing a challenging situation. They are hemmed in by extension of cultivated areas and find their traditional source of fodder supply shrinking. Besides, they have to migrate during summer to places near river beds with perennial supply of green grass. These places are marshy and have no satisfactory arrangements for drinking water. On their way from their original location to places of fodder supply, the cattle have to face difficulty in shelter, water and feed conditions. The traditional breeders are, therefore, gradually becoming extinct.

Among well defined breeds, there are two broad divisions, those which may be described as dairy breeds and those that are purely for draught, though there is a good proportion which produce a fair quantity of milk as well as bullocks of average working efficiency. The well known milch breeds of cows are *Ahiwal, Sindhi* and *Gir* while *Amritmahal, Mangayam,* and *Kankrej* are breeds noted for producing good bullocks. The *Hariana* and *Tharparkar* are the best known dual purpose breeds of India. *Ongle* and even *Kankrej* can be described as dual purpose breeds.

The well known buffalo breeds are *Nili Rani and Murrah* from Punjab and Delhi and *Mehsana, Surti, Jaffarabadi* from Gujarat.

Cattle Prices : Cattle prices vary from place to place and breed to breed. In view of the large number of breeds and variations among them, their classification and gradation for market purposes is difficult. Besides, the standard of evaluation vary from buyer to buyer, occasionally being influenced by fancy for a specific colour and auspicious marks. The price differentials are, therefore, associated not only with age, sex, utility or type, but also with non-economic considerations. By and large, the price of a young animal upto the

age of 3 years is low as it is comparatively raw and untrained. Prices begin to appreciate between the 4th and 7th year in case of draught cattle and thereafter begin to decline. Recent data regarding prices are not available. However, at present the price of a good *Kankrej* pair of bullock would be about Rs. 1,500 (at age of 6 years). For non-descript breeds it may be as low as Rs. 400 (at age of 6 years).

In the case of dairy cattle, the price is directly proportional to milk yield and varies with the number of lactations. Usually a higher price is paid for a milch cow in her first and second lactation and for a buffalo in her third and fourth lactation.

Cattle prices also fluctuate from season to season, the reasons being different for draught and dairy cattle. For draught cattle, the prices rise at the commencement of agricultural operations when the demand for the plough bullock is at its maximum level. Supply predominates in the slack season due to fodder scarcity and the price falls. The period of commencement of the agricultural operations—especially *rabi* operations—varies from region to region and crop to crop. In wheat growing areas, the autumn prices would be slightly higher than those in spring ; and in cotton areas, prices would be higher in June than in November. In the case of dairy cattle, prices rise and fall depending upon the regularity of milk supplies. Prices of slaughter stock are generally low after January or February when the influx of unwanted animals from rural areas begins due to increased scarcity of fodder during these months.

Though buffaloes form only 38 per cent of the milch animals, they contribute 54 per cent to the total milk production compared to 42 per cent contributed by cows. This is explained by the fact that on an average, a buffalo yields 499.4 kg. of milk.

Animal Husbandry Development: The Third and subsequent Annual Plans attached considerable importance to animal husbandry. A new cattle breeding policy was evolved during this period. According to this policy, cross breeding would be undertaken in areas covered by Intensive Cattle Development (ICD) projects and in key village blocks that lie in the milk sheds of existing and proposed dairies. Pure breeding would be confined to outstanding indigenous breeds in well defined breeding tracts with a view to improving the quality of milch cattle. Simultaneous upgrading of indigenous cattle would be undertaken with recognised Indian breeds. Greater efforts would be made for the improvement of the productivity of buffaloes.

The introduction of ICD projects during the period 1961—69 represents a significant development. The programmes include improved methods of breeding, provision of feed and fodder and disease control. Earlier, the cattle development programmes, taken

up in small and scattered areas, could not make much impact on account of insufficient inputs, lack of tie-up with proper marketing and inadequate coverage of cattle population. The ICD project was conceived to rectify these short-comings.

Objectives and Targets : The approach to livestock development in the Fourth Plan is based on three major considerations. First, it is estimated that only about 12 per cent of the agricultural component of the Gross Domestic Product is accounted for by livestock production in India. The second consideration is nutritional. Compared with cereals, the demand for livestock products is more income elastic and it is likely to grow at a rate between 5.5 to 6.4 per cent per annum. The third major consideration is that animal husbandry offers considerable scope for diversification of the economy of the small farmer and the landless labourer.

In the light of these considerations, the Fourth Plan aims at increasing the supply of protective foods like milk, milk products, meat and eggs and at improving the output of certain animal products of commercial importance, such as wool, hides, skins, hair, bristles and bones. It is also one of the principal endeavours of the Plan to help ensure that animal husbandry programmes stengthen the economy of sub-marginal farmers and agricultural labour.

In setting up targets of livestock development, consideration has been given to the constraints that are still operating in this sector. The first major constraint concerns absence of a significant research break-through comparable to that in cereal crops. The second constraint concerns feed and fodder, while the third arises from the fact that a large percentage of the bovine population has to provide draught power for agriculture, thus leaving relatively limited scope for a milk oriented cattle breeding policy. There is also lack of sufficient integration between crop husbandry and livestock production with the result that these programmes do not adequately reinforce each other. Again, there is the limitation arising from an intense competition for land and water resources. An extremely small area is devoted to fodder cultivation and pasturage. Certain animals, particularly sheep, are reared by nomadic groups moving up and down the mountain ranges in the Himalayas or from arid to semi-arid tracts in the plains. In these circumstances, a continuous and consistent programme of extension and improvement of quality of animals becomes doubly difficult.

The public sector outlays are proposed to be supplemented from various institutional sources. The Agricultural Refinance Corporation (ARC) has already financed several poultry and dairy development schemes. It is expected that, in the coming years, the role of the ARC in this sector would be enlarged. Another significant

source of finance particularly for purchase of milch animals is co-operative credit. The All-India Rural Credit Review Committee had recommended that such credit should also be available to persons who carry on animal husbandry activities without undertaking crop husbandry. The measures are expected to increase the flow of co-operative credit and, in particular make it accessible to small farmers and landless labour for their poultry and dairy activities.

Cattle Breeding Policy : The main features of recent cattle breeding policy are :

(i) Selective breeding in the breeding tracts of established or recognized milch, dual purpose, or some important draught breeds of cattle.

(ii) Laying more emphasis on milk production in the breeding tracts of draught breeds or types of cattle and replacing the other existing draught breeds or types with dual purpose breeds.

(iii) Grading up with recognized dual purpose or dairy breed in areas where cattle do not conform to any specific type of breeds and are usually non-descript and of low productivity.

(iv) Cross breeding with exotic breeds in hilly areas and other places where there are facilities for the rearing and maintaining of high yielding milch cattle and urban areas and around industrial townships to ensure adequate supply of milk.

(v) Improvement of buffaloes by selective breeding in breeding tracts and grading up with recognized breeds in other areas where buffaloes have established themselves.

The main emphasis of the new cattle breeding policy is on cross breeding. 8.5 lakh animals were bred by artificial insemination and 1.75 lakhs by natural services during 1970-71. The rate of progress in this respect will, however, depend upon the degree of the farmers' acceptance of cross-bred humpless animals as working stock. While a measure of progress has already been achieved in cross breeding, certain technical problems in regard to exotic inheritance are yet to be finally resolved, so as to achieve a measure of stability in the desired characteristics.

Intensive Cattle Development Programmes : With the object of increasing milk production particularly in milk shed areas of large dairy plants, the establishment of Intensive Cattle Development (ICD) projects were started from 1964-65. Thirty-four ICD projects were established upto the end of 1968-69. During the Fourth Plan it is envisaged to set up 37 such projects. Ten projects were set up in 1969-70 and 6 more in 1970-71.

The availability of proven bulls is a pre-condition for the improvement of breeds. During 1970-71, 8.5 lakh animals were bred

by artificial insemination and 1.75 lakhs by natural services. 2.64 lakh castration and 63 lakh prophylactic vaccinations were performed. A beginning has been made with the progeny testing units. In the Fourth Plan, a Centrally sponsored scheme will provide for progeny testing units at 10 State farms. For cattle development, schemes in the Third Plan and the Annual Plans included breeding farms, bull rearing farms, *goshala* development, control of wild and stray cattle and organization of mass castration. These programmes will continue. Three central cattle breeding farms and eight bull rearing farms will be set up. Sire evaluation cells will be established in each State.

However, the ICD project has yet to make a significant progress. A conference of the project officers held in October 1970 made special mention of two difficulties *viz.* inadequacy of funds provided by the States and non-availability of adequate quantities of seeds of high yielding varieties of fodder.

Buffalo Development: The demand for the buffalo as a dairy animal has increased in recent years on account of the high yield and rich fat content of its milk. Of the eight well defined breeds of buffalo, the *Murrah* breed, which is the most popular among the high yielders, has adapted itself well all over the country. An important scheme, continued from the Second Plan relates to the salvage of *Murrah* buffalo calves from milk colonies for distribution all over the country. In the Fourth Plan, an All-India Co-ordinated Research Project on buffaloes is envisaged. The objective is to improve the production potential of buffaloes through assessment of vital characters, selection for high economic value and development of breeds with the help of different systems of breeding. Research is in progress for overcoming the reproductive failures among buffalo cows during summer months. Some causes have already been identified. Further research work is contemplated in the Fourth Plan.

Sheep and Goat Development: The clip of Indian sheep is generally of coarse quality and the bulk is classified as carpet wool. Wool and wool products such as carpets, blankets and druggets earn valuable foreign exchange. Considerable quantities of the indigenous wool are being utilized in the woollen manufacturing industries. There is also demand for raw wool in the export market. To improve the quality of wool from indigenous sheep, the development programme envisages cross breeding of local sheep with exotic fine wool varieties as well as upgrading with some of the important local breeds. To produce quality stud rams of important indigenous breeds of sheep and exotic breeds, the programme envisaged establishment of 8 large sheep breeding farms with a flock strain of 5,000 or more sheep, expansion and reorganization of 15 State sheep breeding farms, establishment of 5 new sheep breeding farms and 50

sheep and wool extension centres besides the expansion of 80 centres established during the Third Plan. A large central sector sheep breeding farm is being set up at Hissar with Australian assistance. Australia has already supplied 1,030 corriedle sheep as part of the foundation stock, besides providing the services of experts and agricultural equipment for land development. Import of fine wool breeds of sheep and mutton types is envisaged to popularize improved method of sheep shearing, wool grading and marketing on the basis of the quality. The programme is being taken up in 8 States with UNDP assistance. It is proposed to organize farms for *Pashmina*, Angora and dairy goods.

Poultry Development : With the growth of poultry as a commercial enterprise during the last decade, poultry farming has become lucrative. The Agricultural Refinance Corporation has already provided finance for poultry projects. A favourable atmosphere has been created for the growth of ancillary industries such as organized poultry feed, poultry equipment and sales organizations for eggs and dressed birds. Propagation of stock with high feed conversion efficiency is important for bringing down costs. It is proposed to take up a co-ordinated poultry breeding programme at three Central and ten State farms to evolve superior lines and to cross them in various combinations with a view to exploiting hybrid vigour. One hundred intensive egg and poultry production-*cum*-marketing centres will augment supplies. The State Governments have been asked to set up State level organizations in the co-operative and corporate sectors to take up marketing of eggs and poultry on modern and scientific lines.

Piggery Development : Development of piggery is becoming increasingly important. Pig breeders are being supplied improved pigs and technical know-how in piggery development blocks. In some areas, supply of balanced feed for pigs has also been taken up. In order to improve the economic condition of those who have adopted pig rearing as a traditional occupation, it is proposed to supply them breeding stock at subsidized rates. The bacon factory at Haringhatta will be provided additional facilities. Work would be completed in remaining three bacon factories and one pork processing plant. Four more plants are proposed to be set up in different States. To ensure regular supply of improved pigs, 10 piggery farms would be expanded and 25 new piggery development blocks would be set up.

Feed and Fodder Development : Increase in the productivity of livestock has been hampered by shortage of feed and fodder. Only about 4.5 per cent of the cultivated area is under fodder. This is

not capable of supporting more than a small fraction of the livestock population. Stress will be laid on developing feed and fodder resources under the ICD projects and key village blocks. In 1970-71, 10,874 quintals of good quality seeds of fodder crops and 234 lakh roots/steps of perennial grass were distributed for cultivation purposes. 51,659 fodder cultivation demonstrations were organized. For meeting emergent requirements, it is proposed to set up 5 fodder banks in suitable areas where the available grass production will be harvested and conserved. It is also proposed to popularize silage and hay making by organizing demonstration on cultivators' holdings in the milk sheds of dairy projects. Seven regional forage demonstration stations will be set up. Of these, three stations at Hissar, Kalyani and Ankleshwar have already started and one more station has been selected at Alamadhi (Tamil Nadu). Foundation seeds will be multiplied at 20 seed farms.

Livestock Marketing : Marketing of livestock and livestock products has not developed to the same extent as that of other agricultural commodities. Marketing activities have been confined to regulation of cattle markets and to some extent to the grading of livestock products. Improvement in the conditions of marketing is an immediate need and regulation of markets would be an important step in this context. It is proposed to establish a livestock marketing cell in the Directorate of Marketing and Inspection with the object of developing effective supervisory and advisory control over the grading schemes for livestock products. In addition to this, other schemes proposed are classification of raw hides, improvement in the collection, preparation and grading of material used for manufacture of animal casings and arrangement for grading of wool at producers' level.

Animal Health : Maximum production can be ensured only when animals are healthy and protected against diseases and parasites. It is proposed to set up 200 new hospitals, 1,000 veterinary dispensaries and 2,000 stockman centres and to provide 60 mobile dispensaries. The five hundred existing dispensaries will be converted into hospitals and 60 clinical and investigation laboratories established. In addition to the continuance of the rinderpest eradication campaign in the southern States and the follow up programme in others, the immunization programme against the disease will be intensified by establishing check-posts and creating an immune zone to a depth of about 20 kilometers at inter-state borders. It is proposed to augment the production of tissues culture vaccines against rinderpest and foot and mouth disease and cross-bred animals are more susceptible to these diseases than indigenous breeds. To prevent ingress of exotic diseases, an animal quarantine and certification service will be set up.

Research : The two Central research institutes namely, Indian Veterinary Research Institute (IVRI) Izatnagar, Uttar Pradesh, and the Central Sheep and Wool Research Institute, Avikanagar, Rajasthan, were transferred under the administrative control of the Indian Council of Agricultural Research in 1967. The existing research facilities at both the institutes are proposed to be strengthened and a new plant, Animal Virus Research Institute, would be set up. At IVRI, new divisions of epidemiology, veterinary public health, experimental medicine and surgery and livestock products technology are proposed to be set up. The work of these divisions will comprise investigations on the epidemiology of various important diseases and their control measures, study of safety, efficacy, viability and applicability of newly developed medicines under control conditions and systematic research to evolve better techniques of collection, processing, packaging and marketing of meat, meat-meal, bones, bone meal and animal casing.

Since consumption of animal products has been steadily rising, various types of microbial food poisoning are likely to present problems. The two main aspects of research proposed concern the diseases communicable from animal to man and *vice versa* and the problem of rendering animal products safe for human consumption. For the control of foot and mouth disease, a vaccine has already been developed. Further research on this disease will be intensified for developing a potent vaccine for pigs. Under a co-ordinated project, typing of foot and mouth disease viruses would be undertaken. A number of co-ordinated multi-disciplinary research projects are proposed to be taken up for producing better productive strains of different species of livestock through adoption of scientific methods of breeding, feeding, management and disease control. At the Central Sheep and Wool Research Institute and at its two regional stations near Kulu and Kodaikanal, research will be undertaken on sheep breeding, management, health and wool processing technology.

Dairying and Milk Supply : Dairy development was given considerable emphasis from the beginning of the First Five Year Plan. The main problem related to supply of milk to large cities under hygienic conditions supported by schemes of procurement from rural areas. The progress during the First Plan was quite encouraging in the sense that the provision of Rs. 7.81 crores made in the Plan was more or less fully utilized.

In the Second Plan, stress was laid on establishment of colonies of milch cattle in metropolitan cities on the Aarey pattern. The policy in the Third Plan was to develop dairy projects with emphasis on milk production in rural areas linked with plants for marketing

surplus milk in urban areas. It was envisaged that the supply and collection of milk would be undertaken by producers' co-operatives in rural areas and the processing and distribution of milk and manufacture of milk products would be organized through plants operated as far as possible on co-operative lines. During the period 1961—69, 22 liquid milk plants and 4 milk product factories had been commissioned and brought in operation.

On the eve of the Fourth Plan, the total number of dairy plants in operation was 91, comprising 47 liquid milk plants, 7 milk product factories and 37 pilot milk schemes. Of these, 53 plants are in the public sector, while the rest in the co-operative sector. Most of them are operating at a loss on account of various reasons. In some cases, there was undue time-lag between the initiation and the commissioning of the project due to unavoidable circumstances and this added to the capital cost. Many plants have taken a long time to develop the operation to their full installed capacity. While some efforts to introduce balancing plants have been made, the inherent problem of fluctuation in milk supply between the flush and the lean season continues.

The programme has made further advance during 1970-71. The average output of milk of all the plants increased to 22.50 lakh litres a day as against 20.00 lakh litres in the preceding year, representing an increase of about 12.5 per cent. Seven liquid milk plants at Vishakhapatnam (Andhra Pradesh), Ranchi (Bihar), Kottayam (Kerala), Gwalior (Madhya Pradesh), Gulbarga (Karnataka), Mathura and Gorakhpur (Uttar Pradesh) were commissioned during the year. Besides, 9 small units started functioning at Burhanpur, Bilaspur, Khandwa, Katni, Raipur, Ratlam, Rewa, Sagar and Ujjain in Madhya Pradesh. Two large sized milk product factories were commissioned at Moradabad (Uttar Pradesh) and Jind (Haryana), the former with the assistance under the Third Line Danish Credit and the latter under the Yugoslav Credit. The total number of dairy plants in operation increased to 106 units, comprising 60 liquid milk plants, 7 milk product factories, 3 creameries and 36 pilot milk schemes as against 96 units comprising 53 liquid milk plants, 5 milk product factories, 3 creameries and 35 pilot milk schemes.

In the preceding year, in addition, 28 dairy projects, including development of pilot milk schemes into full-fledged units, were in various stages of implementation.

Most of the large sized dairy plants, including the Anand-Mehsana dairy complex in the co-operative sector and the Hyderabad-Vijaywada dairy complex in the public sector have shown substantial improvement in the procurement of milk over the earlier years. The plants at Ahmadabad, Agra, Aligarh, Baroda, Calicut, Chandigarh,

Delhi, Hyderabad, Kanya Kumari, Mehsana, Trivandrum and Vijayawada exceeded their installed capacities in respect of output. The overall increase in the procurement of milk could be attributed primarily to the adoption of better procurement and pricing policies by the project authorities.

In the field of milk products manufacture, there has been appreciable improvement. The country is now self-sufficient in these products, except milk powder which has to be imported to offset the seasonal shortfall in the milk production and to maintain the level of milk distribution to the consuming public in the major cities/ towns. The milk product plants at Anand, Mehsana, Amritsar, Jind, Moradabad, Rajkot and Vijayawada increased their output to the level of about 45 tonnes of milk powder (including infant milk food) per day as against 40 tonnes per day manufactured in the preceding year. Of the milk products, the quantity of table butter and ghee manufactured was around 35 tonnes per day as against 30 tonnes in the previous year. There was good progress in the establishment of a composite milk plant at Barauni (Bihar) for which the equipment has been procured under the Swedish Credit Programme. Civil works of the project are in progress. At the Miraj composite milk plant, the erection of works have been taken up for the completion of the second phase of the project aimed at manufacturing milk products.

In the field of dairy equipment manufacture, the country has become almost self-sufficient. All equipment, except certain items of higher capacity and a few specialized and sophisticated items, required for the establishment of dairy plants, are now being manufactured in the country. This has enabled the country to save considerable foreign exchange.

Objectives and Outlays : As some of the existing dairy projects are operating at a loss, one of the principal tasks in the Fourth Plan is to take corrective measures. This will include changes in the milk pricing policy and introduction of modern management practices. The desirability of changing the management of public sector projects from departmental to corporate form will have to be pursued. It will also be necessary to establish a direct link between the small producers and the public sector milk plants through co-operative organizations. Dairy projects will need to be encouraged to take up extension work under their own auspices. At present, a number of dairy projects balance their operations by using imported milk powder. A phased programme is intended to be drawn up to increase production in the milk-shed areas and gradually eliminate dependence on imported milk powder.

The organized sector of the dairy industry will be extended to

smaller towns with emphasis on milk production in the rural areas. Measures will be taken to ensure that dairy projects are economically viable and, as far as possible, organized in the co-operative sector.

The financing of dairy development will be based on three principal sources, namely, Plan outlays, institutional finance and counterpart funds generated by the sale of commodity gifts under the World Food Programme. As far as institutional sources are concerned, the Agricultural Refinance Corporation has already entered the field and financed one dairy project. Further suitable schemes will have to be formulated for financing by the ARC. Briefly, it is expected that funds of the order of nearly Rs. 95.40 crores will be generated and will form part of the Plan outlays. On this basis, the total outlay under the Plan will be of the order of Rs. 138.97 crores.

In the Fourth Plan, first priority will be the completion of the 33 dairy schemes which spill over from the earlier period. In addition, organized dairy industry will be extended by taking up 24 new schemes in towns with a population of about 50,000. Furthermore, four milk product factories are proposed to be established. In addition, 64 rural dairy centres will be organized in areas with a population of less than 50,000 with a view to providing chilling and marketing facilities in isolated pockets of milk production.

Project for Milk Marketing and Dairy Development : With the co-operation of the World Food Programme (WFP) the Ministry of Agriculture has formulated a project for stimulating milk marketing and dairy development in India. Under this project, the WFP will supply, free of cost, during the five-year period from 1970-71 to 1974-75, 126 thousand tonnes of skimmed milk powder and 42 thousand tonnes of butter oil, worth Rs. 41.90 crores at international prices. After recombination of the skimmed milk powder and butter oil into liquid milk at the public sector dairies at Bombay, Calcutta, Delhi and Madras, the milk will be sold and the sale proceeds estimated at Rs. 95.40 crores will be used for increasing milk processing facilities of the public sector dairies from one million litres at present to 2.75 million litres per day at the end of the five-year project period. The generated funds will also be used for increasing milk production and procurement in the ten neighbouring States and the Union Territory of Delhi. This will be achieved by the provision of technical inputs which will include production of ready mixed concentrates and green fodder, artificial insemination, veterinary services and medicines, calf rearing assistance, development of improved milch animals and organization of rural procurement of milk. The project will also provide for the resettlement of the city kept cattle and buffaloes in the adjacent rural areas.

For the implementation of this project, Government have set up an Indian Dairy Corporation with headquarters at Baroda. Upto the end of April 1971, the World Food Programme has supplied 9,299 tonnes of skimmed milk powder and 3,100 tonnes of butter oil against 10,500 tonnes of skimmed milk powder and 3,500 tonnes of butter oil expected from them during the period July 1970 to June 1971. Funds to the extent of Rs. 3.72 crores have been generated upto end of April 1971 against the anticipated investment of Rs. 7·81 crores during July 1970 to June 1971 (the first year of the Project). In order to meet the requirements of the first phase expansion programme of the public sector milk plants, estimated to cost Rs. 1.91 crores, the Indian Dairy Corporation has placed or are placing indents amounting to Rs. 1.8 crores, on UNICEF for the import of dairy processing equipment and components. Deliveries are expected to begin in June-July 1971. The balance of the amount is being made available from free foreign resources. The requirements of plant and machinery for the second phase estimated to cost Rs. 25.26 crores have been discussed with the indigenous manufacturers and D.G.T.D. and items of the value of Rs. 13.96 crores will be imported. A stockpile of scarce indigenous iron and steel material is being collected to facilitate indigenous production of the remaining dairy processing equipment of the value of Rs. 11.30 crores. State-wise and area-wise break-up of Rs. 95.40 crores expected to be generated from the sale of WFP commodities, have been worked out and communicated by the Corporation to the respective State Governments. They have been asked to formulate concrete projects within these allocations.

XVI. Fisheries

With a coastline of about 4.8 thousand kilometers and a continental shelf of more than 2.6 lakh square kilometers, India has a rich potential for a thriving fishing industry. There is hardly any month during which fishing activity has to be stopped altogether; fish of some type or the other is available during most parts of the year. India has also long stretches of inland watercourses in which fresh water fish breed.

With these vast acquatic resources, actual production of fish in the country is rather meagre. Although the industry provides employment for over a million persons, the total production of fish in the eountry from marine and inland fisheries was only 1,075 and 671 thousand tonnes respectively during 1970. India ranks tenth among the world's fish producing countries.

One of the major reasons for the tardy development of the fishery industry in India till recently was the lack of adequate market

demand. Nearly one-third of the total population does not habitually eat fish; fish eating is a religious taboo to them. The other two-thirds of the total population eats less fish, mainly due to low income. Per capita fish consumption amounted to only 3.5 kg. per year for the fish eating population. For the entire population, it averaged to 2.3 kg. per year. Even this small figure of Indian consumption is very unevenly distributed in the country. West Bengal, the leading consumer, takes 2.9 kg. per head while Punjab consumes only 0.4 kg. and Bihar less than 1 kg.

In most of the advanced countries, the level of fish consumption per capita per year is much higher. In U.K. it is 18 kg., in Denmark 10.5 kg., in Germany and France about 8 kg., in U.S.A. 7 kg. and in Italy and Switzerland 5 kg. and 3 kg. respectively. Even a small country like Sri Lanka —our southern neighbour—consumes as much as 16.4 kg. of fish per capita. Thus, increase in demand upto even a modest level of consumption would require a substantial increase in fish production.

It is estimated that of the animal food consumed by man, fish forms about 3 per cent of the total in the world though the percentage in some areas like Ireland, Newfoundland, parts of Norway, and Japan is comparatively much higher.

Poor techniques of production and negligence by the State for a long time accounted for low production. The continental shelf extend over 100 fathoms on the 4,300 kilometres of cast giving 2.9 lakhs square km. However, because of elementary and crude implements and small and primitive boats of canoe types used for fishing, only a small portion of the large continental shelf has, as yet, been exploited. Of the innumerable esturine sources, perennial rivers, irrigation works and confined waters of tanks, ponds, etc., very few are used for pisciculture due to customs of the people and a low social status, of the fishing occupation. Mostly, illiterate people equipped with traditional skill are engaged in fishing. Besides, there are only a few good harbours. Also there is hardly any facility for refrigeration, and curing yards have been established only recently. This makes transportation difficult and marketing expensive.

Fishing is under the administrative jurisdiction of the State Governments. Till 1958, the Fishing Department was part of the Revenue Department and as such it paid scant attention to the development of fishing. The State Government was not willing to spend and invest in development of fishing out of its other revenues. Deep sea fishing has been recently taken up with the mechanization of some of the boats.

Production of Fish : Our land and sea resources yield, at present, only a fraction of what they could if exploited on modern lines.

Although as many as 1,500 kinds of fish are known to exist in India, only a few types are caught in appreciable quantities, and so far we have not been able to tap more than 5 to 6 per cent of our entire fishable marine area. In the past, nearly one-third of the total catch was wasted due to the shortage of ice, necessary for preserving fish. From the year 1950, statistics on the catch of marine fisheries have been developed by the Central Marine Fisheries Research Station, Mandapam. It has now a network of selected observation centres spread on the East and West Coast of India which form the main sources of marine fish supply.

Important sea fishing areas are confined to the coastal waters extending from 8 to 16 kilometres from the shore of Gujarat, Kanara, Malabar Coast, Tamil Nadu, Coromandal Coast, and the Gulf of Mannar. Of all these, Tamil Nadu with the best organized fisheries department holds a highly creditable record. Its 2,800 kilometres coastline is surrounded by over 1 lakh square kilometres of shallow sea water. The Tamil Nadu Government was the first to take interest in the industry about three decades back. A wide range of activities connected with this industry from the manufacture of 'Fish Guano' manure to pearl buttons and bangles are seen in the State.

Of the total production of marine fish, as much as 35 per cent is produced in Kerala alone and adding three other important South Indian States—Andhra Pradesh, Tamil Nadu and Karnataka, nearly two-third of total production comes from this region. Another 30 per cent is produced in the western region of Gujarat, Maharashtra, Goa and Laccadive Islands. The only other State which is of some significance in the east is West Bengal which during 1970 produced over 31 million tonnes of marine fish. As regards inland fish, here again the southern States of Andhra Pradesh, Tamil Nadu, Karnataka and Kerala put together account for nearly one-half of the total production. The share of Maharashtra and Gujarat in the west is quite negligible but the eastern State of West Bengal and Uttar Pradesh in the north contribute substantially to this total production.

The bulk of marine fish production comes from the inshore areas in which non-powered as well as small powered craft operate. The strategy of development has been to intensify the fishing effort with powered craft in this sector while developing the infra-structure for fishing in off-shore and deep sea areas. About 730 mechanized boats were programmed for introduction in the various maritime States during the year 1970-71 to add to the fleet of 8,230 powered boats already in operation. Integrated projects covering boat building, fishing and marketing have been formulated in several maritime States. To assist the development of machanized fishing, harbour facilities are being provided at several points round the coast. For

the development of deep sea fishing efforts have been intensified on location and charting of fishing grounds, provision of larger harbours and training of personnel. Measures have also been taken to ensure availability of deep sea fishing vessels through indigenous construction as well as by limited imports. In addition to larger harbours designed to handle deep sea fishing as well as mechanized boats, harbour facilities estimated to cost nearly Rs. 46 lakhs are being provided at 40 sites spread over several States.

Fishing Harbours : The work of construction of deep sea fishing harbour at Sasoon Docks, Bombay, estimated to cost Rs. 4.74 crores commenced during the year 1970. Work is now continuing on the construction of deep sea fishing harbours at Tuticorin in Tamil Nadu, Vishinjam in Kerala and Karwar in Karnataka, which are estimated to cost Rs. 208 lakhs, Rs. 173 lakhs and 24.86 lakhs respectively. A fishing harbour at Port Blair, at an estimated cost of Rs 50 lakhs, which will handle deep sea fishing vessels and mechanized boats, has been sanctioned during the year. The construction of a harbour costing about Rs. 151 lakhs which will provide facilities for 15 large deep sea fishing vessels at Roychowk on the Hooghly has also been approved. A project report for a large deep sea fishing harbour at Cochin has been prepared and plans and estimates are under preparation for fishing harbours at other major ports. The UNDP Fishing harbour pre-investment survey project is continuing investigations of suitable harbour sites and preparation of designs and estimates. The project has conducted reconnaissance surveys of 16 sites in Andhra Pradesh, 6 sites in Karnataka, 5 sites in Maharashtra, 5 sites in Kerala and 7 sites in Orissa. The project completed economic studies and detailed engineering surveys and soil mechanics investigations at Malpe, Honavar, Ratnagiri, Kakinada, Nizampatnam and Narsapur. Plans and estimates were drawn up by the project for the first three harbours.

Fishing Vessels : Orders were placed by the Government of India and State Governments between August 1968 and February 1969 with the Indian Ship Building Yards for construction of 40 deep sea fishing vessels of 17.5 meters overall length. In order to encourage the use of indigenously constructed vessels, a scheme has been introduced under which indigenously constructed steel deep sea fishing vessels will be subsidized upto a limit of 27.5 per cent of the c.i.f. cost of an equivalent imported vessel. During the year, a few orders were placed by the fishing industry on foreign yards for the deep sea fishing vessels under a scheme of limited import. The fisheries industry will receive a big boost when India's first fibreglass reinforced plastic boat fabricating factory is commissioned in Mangalore.

Indo-Norwegian Project : According the Indo-Norwegian Project entered between the Governments of Norway and India, the Norwegian team provides expert assistance in various fields of fishery technology, engineering, navigation and fish processing and counterpart technical personnel were trained under their guidance. The activities under the project include deep sea exploratory fishing, demonstration of modern technology with special reference to processing and marketing and training of personnel. Encouraged by the results of the deep sea trawling operations carried out on the South-West Coast, exploratory trawling for deep sea prawn and lobster was extended to the East Coast. The surveys indicated occurrence of the same species of deep sea lobster already located on the West Coast, in appreciable quantities at several places in the Gulf of Mannar along the 125 fathom belt. Several species of deep sea shrimps were also located along the 150 to 200 fathom zone. Thus, a fishery for deep sea lobster and shrimp has become available for commercial exploitation along the South-West as well as the South-East Coast. Purse-seining operations were initiated during the year in the Laccadive Sea and it is proposed to carry out further operations with the help of a new vessel to be acquired shortly with Norwegian aid. Sanction has been issued for staff and equipment for two modern fish stalls at Coimbatore and Bangalore under a scheme designed to demonstrate and promote internal marketing of marine fish under hygeinic conditions.

Preservation and Transport: For proper preservation and quick transport of fish from landing areas to interior markets, one ice plant, two cold storages, one freezing plant and one frozen storage were commissioned under State programmes. In addition, work was in progress under these programmes for erection of 28 ice plants, 24 cold storages, 7 freezing plants and 8 frozen storages. Besides this 3 refrigerated rail vans for transport of fish are under construction.

Types of Fish : For a vast country like India, physical and biological conditions under which fisheries exist are varied. This gives a large variety of fish. They have local popular names. Matching of these names with their English equivalents is not possible in all cases. The first comprehensive and systematic classification of fishes on an all-India scale was made in 1876—1889. Subsequently, some of the State Departments attempted to rename some varieties. However, Day's classification is still common and is widely accepted.

There are 14 major groups of commercial fishes with several types included in each of them. These groups are (i) Elasmobranchs which included sharks, saw fish, skates and rays (ii) Eels (both marine and

fresh water), (iii) Cat-fishes (marine and fresh water), (iv) Bombay-duck, (v) Feather backs, (vi) Mackerels and the Perches, (vii) Silver Bellies (viii) Pomfrets, (ix) Elat fish, (x) Mullets, (xi) Indian Salmon, (xii) Jew fishes, (xiii) Live fishes other than Cat-fishes, and (xiv) Carps. Of these, Carps and Live-fishes other than Cat-fishes are found in rivers, tanks, etc. all over India. Indian Salmons (Limn especially) are found in Saurashtra, Mullets only in large rivers, Pompfrets in gulf of Cambay, and in certain areas of Coromondal Coast, Feather-backs in fresh and brackish water, and Bombay-duck off Bombay coast. Sharks, Herrings and Skates are found mostly in the Bay of Bengal, and Marine Eels again on Bombay coast. Mackerels are mostly available in Madras and Kerala coastal areas and Silver-bellies on South-West coast of India. Prawns are found over wider areas of Kerala, Kutch, Bombay and Bengal, but lobsters in the same group (of Carps) are found in West Bengal areas.

In the various types of marine fish, quantitatively, the major share was contributed by (i) Mackerels and Perches, (ii) Crustaceans, (iii) Herrings and Anchovies, (iv) Bombay-duck, and (v) Jew fish. During 1950—59, the production of Bombay duck increased several fold and that of prawns, shrimps and other crustacean and Cat-fish nearly doubled after the Second Plan. Production of the more popular but quantitatively less important varieties like Pomfrets has registered substantial increases. The data regarding the output of various types of fresh water fishes are not available.

Disposition of Catch : Data on the disposition of nominal catch in India are available over the years. This gives some idea of the quantities marketed fresh, cured, canned, used for miscellaneous purposes and offals for reduction, etc. Of the total production of 1,746 thousand tonnes during 1970 as such as 1,170.5 thousand tonnes was marketed fresh. Of the balance, total quantity cured was 354.3 thousand tonnes. Curing is done sun-dried or salted. During the year 1970, the quantity of sun-dried fish was 202.2 thousand tonnes and salted was 152.1 thousand tonnes. Besides the small quantities canned put for miscellaneous use, 95.8 thousand tonnes were used for reduction and 80.2 thousand tonnes for freezing.

Utilization of fish for food and other purposes varies from year to year. Popular prejudices against certain types of fish depend on appearance. Since shoaling conditions would vary every year, quality of produce also varies. In maritime States, fresh water fishes are consumed almost fresh but small quantities of marine fish are sun-dried. Fresh water fishes are sun-dried on a commercial scale in Assam and West Bengal. In coastal areas, sun-dried fish is consumed only during monsoon. Of fresh fish, sharks

are in good demand in Tamil Nadu and southern States, but poor demand in Bombay city.

On the whole, Pomfrets, seer fish, Mullets and Indian Salmons are in good demand because of their clean appearance, firm flesh, small bones and good taste. A peculiarity about Indian demand is that those used to fresh water fish do not eat sea fish and *vice versa.* In India, fish is eaten as fish curry with rice and *chappatis* or is fried in fat (ghee or oil) along with other vegetables. Sardines, mackerels, seer fishes, eel fishes, Pomfrets, sharks, prawns, etc., are salted. Mackerels and seer fish are pickled.

Imports and Exports : Imports of fish have fallen in recent years to a negligible figure of 29 tonnes during 1969-70. They were actually only 4 tonnes during 1966-67 as against 31.5 thousand tonnes during 1962-63. Small quantities being imported now consist of fish products and fish preparations in containers. Even earlier, imports of this type were not very large. The major type of fish imported earlier was fresh, chilled or frozen type as well as salted, dried or smoked.

Fish and fish products are making a significant contribution to our foreign exchange earnings. But even now India's share of the world trade in marine products is barely 2 per cent. In view of the growing world demand on the one hand and the large potential available in India for augmenting supplies on the other, the scope for increased exports of fishery products from India appears to be immense. In the last few years, there has been a steady increase in the export earnings from fish and fish products. India exported 15.5 thousand tonnes of fish and fish products valued at Rs. 3.91 crores in 1961-62. The exports went up to 29.5 thousand tonnes with a foreign exchange earning of Rs. 30.83 crores in 1969-70, the highest record so far (Table XXXVIII).

Ninety per cent of the country's exports consist of fresh, chilled, frozen and canned fish and the principal export varieties are prawn, shrimp, frog legs and lobsters. In 1968-69, export of prawn and shrimp fetched Rs. 19.70 crores out of the total foreign exchange earnings of Rs. 22.17 crores from fish and fish products. The U.S.A. and Japan have emerged as the biggest importers of Indian prawn and shrimp over the last few years. France and Belgium are the two other potential markets. There is an increasing demand for shrimp in the U.S.A., Japan and Europe and India can hope to benefit by it only if she is able to meet the product requirements.

The demand for prawn in Japan is to be increasing at a rate of 17 to 18 per cent per annum and Japan is, therefore, keen on developing new sources of supply. India is a very promising source of supply as she is close to Japan after Thailand. The Japanese market for

prawn is more sophisticated than that of the U.S.A. and only large sized prawns are imported by that country. Six new companies are now setting up prawn processing plants at Visakhapatnam. This is expected to give a big boost to their exports to Japan so as to reach the Fourth Plan target of Rs. 40 crores worth of fishery exports.

In recent years, India has emerged as one of the leading suppliers of frozen frog legs and lobster tails in the world market. In 1961-62, there was hardly any export of these items. In 1968-69, India exported frozen frog legs valued at Rs. 57 lakhs and lobster tails valued at Rs. 84 lakhs. The exports are made mainly to the U.S.A., France, Belgium, Netherlands and West Germany. There is a keen demand and the export of this item can be increased substantially if the supplies to the processing factories are stepped up. Frogs are available in swampy and low lying areas in Kerala, Tamil Nadu, Karnataka, Maharashtra and Andhra Pradesh. They are caught at night with the aid of bright petromax lanterns and delivered in the morning to the processing factories where they are butchered and quickly frozen for export. Only the pair of hind legs of the frogs are used for freezing and are graded according to the size and colour.

Lobster is another highly favoured item of sea food in foreign countries, particularly in the U.S.A. which is the biggest market. The increased demand from abroad for Indian lobsters has given a fillip to this hitherto less exploited fishery. Each kilogram of lobsters fetches Rs. 9 to Rs. 11 in India and when marketed overseas as frozen tail, gets Rs. 31 to Rs. 33. While the industry started with a modest export earning of Rs. 2 lakhs or so in 1962, the export earnings went up to Rs. 12 lakhs in 1965-66 to Rs. 22 lakhs in 1966-67 and Rs. 36 lakhs in 1967-68. The foreign exchange earnings from this source shot up to Rs. 84 lakhs in 1968-69.

Progress under the Plans : Under the Five-Year Plans important programmes relating to exploitation of new fishing grounds, mechanization of fishing boats, improvement of craft and gear, training of fisheries officers and fisheries operators, improvement in landing and berthing facilities, refrigerated transport and fishing requisites, and organizing of processing and canning were undertaken. Investigations were also made at the Central Fisheries Technological Research Institute at Cochin with a view to improving designs of fishing crafts and fishing gear. In addition to the sea fishing station at Bombay, five similar stations were established for operating modern fishing grounds, determining fishing seasons and training of personnel. Two of these stations have, however, been closed temporarily. Two training institutions, one for officers and the other for co-operatives, were set up at Bombay and Ernakulum

respectively. A number of boat-building yards have been established under the coastal States.

About three thousand boats were mechanized during the first three Five-Year Plans and ten fishing harbours were taken up for development. The development of fishing harbours at minor ports was also taken up as Centrally sponsored scheme under the special progrmme during the last years of the Third Plan. Nine refrigerated rail vans were introduced on an experimental basis for the transport of fresh fish from producing centres along the coast to places like Calcutta and Delhi. The possibilities of manufacturing refrigerated and insulated trucks for the transport of frozen and fresh fish within the country are being explored. Proposals for manufacturing of marine diesel engines within the country with foreign collaboration are also under consideration. Efforts are being made to import the minimum number of built-in trucks initially, but later on only refrigeration units will be imported and the State Governments will be asked to build the boats and fit on to Indian chasis.

For the development of inland fishing, considerable progress has been made by raising fish seed production by artificial means and locating additional centres through natural resources. Attention is also being given to the development of reservoir for fishing, stocking, and culture of fish. As a result of these measures, the total production of fish (inland and marine) is estimated to have been increased to about 17.46 lakh tonnes by the end of 1970 as compared to 9.52 lakh tonnes in 1951. The total fish potential of India as against this has been estimated over 10 million tonnes both marine and inland.

Fish being an important export item, efforts are also being made to increase the production of those species which have a big foreign demand. The Ministry of Foreign Trade has fixed an export target of Rs. 48 crores for the Fourth Five Year Plan against Rs. 18 crores during 1967-68. To achieve the production targets under the Plan, an outlay of Rs. 83.57 crores has been fixed.

With regard to marine fisheries, it is important to note that nearly three-fourth of the country's total catch comes from the West Coast which abounds in prawns, sardines, Bombay-duck, Mackerel, etc. It has been estimated that the annual catch amounts to about 800 kg. per fisherman and 8,000 kg. per boat engaged in the industry. Efforts are now being directed towards organizing supplies of fisheries requisites through fishermen's co-operative socities and the introduction of machanized vessels on a large scale.

The Central Institute of Fisheries Education, Bombay, established in 1961 with the object of training fishery officers at the district level, had so far trained 183 candidates. The institute is now regarded as

TABLE XXXVII

Fish Landings In India—Marine And Inland

('000 Metric Tonnes)

States/ Union Territories / Year	All—India			Southern States			Western States			Eastern States			Total
				Andhra Pradesh, Tamil Nadu, and Karnataka			Gujarat, Maharashtra Goa and Laccadives			West Bengal, Andaman and Pondicherry			
	Marine	Inland	Total	Marine	Inland	Total	Marine	Inland	Total	Martne	Inland	Total	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1961	684	277	861	195	135	330	205	10	215	9***	56***	65	72
1962	644	330	974	215	164	379	221	11	232	8***	34***	42	8
1963	655	390	1,045	214	217	431	227	11	238	11	34***	45	—
1964	860	460	1,320	307	260	567	224	12	236	11	103***	114	—
1965	924	507	1,331	242	226	468	229	22	251	20	127***	147	—
1966	890	477	1,367	280	205	485	240	24	264	23**	127	150	—
1967	863	537	1,400	250	228	478	222	24	246	28**	150	178	—
1968	904	622	1,526	294	240	534	230	25	255	39**	212	251	—
1969	912	693	1,605	305	275	580	280	24	304	34**	233	267	—
1970	1,075	671	1,746	336	250*	586	300	26	326	43**	228	271	—

* Included in West Bengal.
** Combined with Haryana
*** Includes Orissa

TABLE XXXVIII

Export of Fish and Fish Preparations from India

Quantity—Metric Tonnes
Value—'000 Rupees

Commodity	1960-61		1961-62		1962-63		1963-64		1964-65	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Fish fresh, chilled or frozen	1,093	761	245	250	348	191	35	112	21	66
2. Fish salted, dried or smoked	13,500	28,245	7,810	12,110	3,298	7,878	9,878	18,848	9,591	17,536
3. Crustacean & Moulscs fresh, chilled, frozen, salted, dried or cooked.	4,553	14,661	6,433	21,632	5,695	23,820	7,340	31,367	9,275	43,919
4. Fish products & fish preparations in air-tight containers	388	2,323	715	4,948	1,513	8,885	1,137	6,763	966	6,741
5. Fish products & fish preparations not in air-tight containers	380	197	502	184	8	38	8	46	3	15
Total	19,914	46,187	15,705	39,124	10,862	40,812	18,398	57,136	19,856	68,277

TABLE XXXVIII (*Contd.*)

Export of Fish and Fish Preparations from India

Commodiiy	*1965-66*		*1966-67*		*1967-68*		*1968-69*		*1969-70*	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
(1)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1. Fish fresh, chilled or frozen	68	115	88	228	82	243	121	664	135	1,062
2. Fish salted, dried or smoked	4,628	6,718	7,049	16,319	4,569	12,164	5,880	15,402	5,678	15,315
3. Crustacean & Molluscs fresh, chilled, forzen, salted, dried or cooked	8,624	49,308	11,069	120,138	13,275	140,160	16,469	181,821	22,090	269,476
4. Fish products & fish preparations in air-tight containers	21	139	1,945	27,216	1,982	26,936	2,054	23,860	1,577	22,464
5. Fish products & fish preparations not in air-tight containers	1,148	9,634								
Total	14,489	65,914	20,151	163,901	19,908	179,503	24,524	221,747	29,480	308,317

the highest educational institute in fisheries in the country and meets to some extent the needs for similar training from neighbouring countries. The inland fisheries training course at Barrackpore and inland fishery co-operative training courses at the Regional Training Centres at Agra and Hyderabad provide training to fishery officers at intermediate and operative levels respectively. Thirty-nine candidates at the Barrackpore unit and seventy-seven candidates at the Regional Training Centres at Agra and Hyderabad were admitted for the courses commencing in 1970.

The Central Institute of Fisheries Operatives at Cochin and Madras provide the training programmes for fishing second-hands, engine drivers, boat-building foremen, shore mechanics and radio-telephone operators.

XVII. Forest Resources

Forests are an important resource of a country. They help to maintain hydraulic cycle through their moderating influence on climate and by attracting rain clouds. They prevent soil erosion by controlling the fury of floods and breaking wind speeds. They help to bind the soil by their foliage. They can be used as a belt to prevent the march of deserts.

In India, the two evils of unplanned land use and soil erosion have caused great damage. Of this, the most devastating effects are seen on the friable soils of Hoshiarpur and Kangra Siwaliks, in Punjab. It is said that when Emperor Jahangir built the castle of Nurpur for Nur Jahan, in the 17th century, the forest was so thick that a bird could hardly spread its wings. Today, it is a denuded hilly area with nothing more than tufts of grass and thorny bushes. This destruction took place in less than 300 years.

Dense forests, which covered the outer Himalayas, have also been reduced to negligible proportions. The same has happened in the Etawah and Agra regions of Uttar Pradesh, Chhota Nagpur, plateau in Bihar and the Nilgiris in the south. There is evidence to the effect that the area around Mathura (Uttar Pradesh) was having regular forests during the Mahabharata age. The destruction of these forests later has enabled the Rajasthan desert to encroach upon South-West Uttar Pradesh, creating a serious problem.

India is still rich in forest wealth. Forest products are varied. Firewood obtained from the forests is the main fuel used in the country because gas and electricity are of little importance as domestic fuel. The farmer uses wood for the manufacture of his agricultural implements and in making houses. His cattle graze in

the forest. Cattle deriving their subsistence by grazing in the forests number as much as 30 to 35 millions.

Forests supply timber for buildings and wood for furniture. Wood is also used for railway slippers and for the manufacture of railway coaches, bus and truck bodies and many other articles of every-day use.

A large number of industries depend upon the products of forests. Bamboo, lac, gum, rosin, tanning materials, medicinal herbs and *kattha* (catechu) are forest products. Match industry, paper pulp including viscose pulp, plywood, sandal wood oil industry, turpentine oil industry, etc., depend solely upon the raw materials obtained from forests. All this provides employment for a large number of people in a variety of jobs, *e.g.*, wood cutting, sawing, carting and as carriers, craftsmen, carpenters, etc., working in and near the forests in addition to people engaged in industries utilizing raw products of the forests.

In so far as employment is concerned, forestry activities are, by and lage, labour intensive. What is more, these activities are practised in such areas where opportunities of employment from other industries are very few.

In India, because of the low per capita income level, the demand for forest products has remained restricted. In contrast, the demand for field crops has been persistently high and has tended to increase rapidly with the growth in population. Field crops, thus compete with forest products for land use. Land under crops expanded rather rapidly during the last three or four decades, resulting in the depletion of forest areas. The relatively low demand for forest products for a long time led to the neglect of forests both by the State and private owners. In some regions, depletion of forest areas and the neglect of forests have disturbed nature's hydraulic cycle, leading to the spread of desert or semi-desert conditions. During the last one and half decade, demand for forest products has been increasing with the expansion of the rayon, paper and match industries. With the expansion of irrigation, afforestation of catchment areas has become a necessity. Marching deserts from the west have also emphasized the need for expansion of forest areas. Government is now seriously engaged in expanding forests and developing forest resources. Sizeable financial allocations have been made in the developmental plans for this purpose.

Forest Area : In India, nearly 50 per cent of the total land area forms the watersheds of 187 river valley projects expected to be completed by 1973-74. Forests in these watersheds will be an important factor in prolonging the usefulness of the projects. Moreover, forests are the main basis of the country's industrial development.

With various uses of forests, it is difficult to establish a set criterion to determine the minimum area necessary under forest in each of the State. For maintaining the hydraulic cycle, it has been suggested that there should be a minimum of 20 per cent of the area under forests. The highly uneven distribution of forest area in different regions leads to extreme variations in climate and rainfall. The total area under broad-leaved forests taken together was 7,07,000 sq. kilometres during 1964-65. The total area under forest in India during 1964-65 was 753,000 sq. kilometres constituting roughly 23.0 per cent of total geographical area in the country. The distribution of the forest area as between different States has been rather uneven. While Madhya Pradesh accounts for as much as 172 thousand sq. kilometres (22.8 per cent), Orissa 68,200 sq. kilometres, (9.1 per cent), Maharashtra 67,100 sq. kilometres (8.9 per cent), Andhra Pradesh 64,500 sq. kilometres (8.6 per cent), a State like Punjab had only 17,900 sq. kilometres (2.4 per cent) of the area under forests (Appendix). About 62 per cent of the forest area in the country is concentrated in seven States—Assam, Madhya Pradesh, Uttar Pradesh, Bihar, Andhra Pradesh, Maharashtra and Gujarat.

Area under forests as a percentage of the total land was low in Punjab, Rajasthan, Uttar Pradesh, West Bengal, and Jammu and Kashmir. In States, such as Bihar, Karnataka, Assam, Andhra Pradesh, Kerala, Madhya Pradesh and Orissa, the proportion of forest area to total land was near or above the minimum as indicated above. In Himachal Pradesh, Madhya Pradesh, Orissa, Tripura and Andman and Nicobar Islands, forests formed over 35 per cent of the total land area, the proportion being more than 60 per cent in the last two regions. Total forest area in each of the State has been classified according to :

1. Type of forests—merchantable and unprofitable or inaccessible.
2. Legal status—reserved, protected and unclassed.
3. Composition—coniferous, sal, teak and miscellaneous.
4. Ownership—Forest Department, civil authorities, corporate bodies and private individuals.

Of the total forest area, as much as 590,000 sq. kilometres (78.3 per cent) is merchantable. Unprofitable or inaceessible forests are mainly located in Maharashtra (28,800 sq. kilometres), Madhya Pradesh (27.5 thousand sq. kilometres), Uttar Pradesh (14,900 sq. kilometres), Punjab (10,900 sq. kilometres) and Jammu and Kashmir (11,900 sq. kilometres).

Most of the forests in India are broad-leaved or non-coniferous in composition. On the hilly part of the country generally coniferous forests grow.

Forest Management : Most of the forest areas are State-managed. In the year 1949-50, the State managed about 77.2 per cent of the total forest area, the remaining 22.8 per cent being owned or managed by corporate bodies or individual owners, the former accounting for 0.3 per cent and the latter for 22.5 per cent of the total forest areas. In 1957-58, the State's share increased to 96.9 per cent subsequent to abolition of intermediate tenures of land and the shares of corporate bodies and individuals declined to 0.1 and 3 per cent respectively. With the nationalization of private forests in Kerala in March 1971, more than 3,000 sq. kilometres of area has come under State control. Kerala forests, which occupy some 27 per cent of the geographical area, are the greatest assets of the State.

Most of the State-owned forests are managed by the Chief Conservator of forests who is responsible for the administration and management of forests. He is assisted by a cadre of trained forest officers. They prepare working plans and conduct silviculture experiments. State Forest Departments seek the advice of the Inspector of Forests, who is attached to the Ministry of Agriculture, Government of India.

Small patches of woodlands scattered over villages and located within village boundaries are managed by Revenue Administration. There is no systematic management or exploitation of these village woodlands. They produce fuel wood and grow *babul* trees covered by small shrubs.

The forest areas managed by Chief Forest Conservator are properly preserved. For this purpose, forests are classified as reserved or protected and the rest are non-classified. Reserved and protected forests are reserved permanently as forests either for production of timber and other forests produce or for other protective purposes, such as prevention of soil erosion, flood, halting deserts, etc. Unclassed forests are not exploitable. These include forest areas which either cannot be worked due to unfavourable physical conditions or have been permanently destroyed but have not yet been put to any other use. The area under reserved and protective forests has continuously increased since 1949-50, consequent upon the acquisition of private forests by the State after abolition of the intermediary land tenures. The Government extended their conservation policy to these areas. Of the total forest area of 763 thousand sq. kilometres, during 1964-65, reserved area was 327.2 thousand sq. kilometres (43.5 per cent) and another 226.0 thousand sq. kilometres (29.9 per cent) as protected.

Felling of old and ripe or useless trees at regular intervals, reforestation of these areas and afforestation of under-stocked or badly stocked areas or of new areas brought under forests are the main constituents of efficient forest management.

Forest Products : Forests in India contribute hardly 0.6 to 0.8 per cent towards the national income. The per capita forest area is 1.8 and 3.5 hectares in the U.S.A. and U.S.S.R. respectively, as against 0.2 hectare in India. The per capita consumption of round-wood in India works out to hardly 0.042 cubic metre, compared with 1.64 cubic metres in the U.S.A. The consumption of pulp products is hardly 0.7 kg. as against over the 34 kg. in U.K.

TABLE XXXIX

Annual value of Imports and Exports of all Commodities *vis-vis* Forest Products (1961-62 to 1969-70)

(Rs. in million)

	Imports			*Exports*		
Year	All Commodities	Forest Products	Column 3 as % of column No. 2	All Commodities	Forest Products	Column 6 as % of Column No. 5
1	2	3	4	5	6	7
1961-62	10,901	270	2.5	6,552	154	2.4
1962-63	11,315	276	2.4	6,781	161	2.4
1963-64	12,229	244	2.0	7,893	167	2.1
1964-65	13,490	252	1.9	8,132	163	2.0
1965-66	13.940	237	1.7	8,056	154	1.9
1966-67	20,784	339	1.6	11,529	186	1.6
1967-68	19,743	323	1.6	11,928	200	1.7
1968-69	18,616	327	1.7	13,563	258	1.9
1969-70	15,675	390	2.5	14,086	276	2.0

The Indian Timber Trend Study based on the 1953-55 situation concluded that, 'The per capita requirement of round-wood is expected to go up by 18 per cent from 1953-55 to 1975, but meanwhile the supply tends to dwindle down by 23 per cent'. This is a big challenge which the Indian forests have to accept. As our supplies of wood fall short of demand, on a rough estimate, 250 million tonnes cowdung is burnt annually as fuel. This is colossal waste and has got to be stopped. There is a heavy demand for special qualities and types of Indian wood in the world. In the

interest of economic development and foreign exchange earnings there is urgent need to increase timber production.

TABLE XL

Output of Forest Products

1961-62 to 1966-67

Q : Thousand cubic metres
V : Thousand rupees

		1961-62	1962-63	1963-64	1964-65	1966-67
Timber	Q	4,287	5,955	6,543	5,926	8,369
	V*	307,478	251,587	441,179	445,163	951,931
Round-wood	Q	1,088	1,549	596	513	
	V	96,021	107,341	47,980	32,965	
Pump and	Q	216	104	14	12	
Matchwood	V	616	1,466	570	2,160	
Firewood	Q**	10,479	12,880	12,259	12,574	12,728
	V	84,370	72,822	99,311	101,278	127,959
Charcoal-wood	Q	386	277	227	186	
	V	5,691	4,058	5,462	4,064	
Bamboo & Canes	V	24,562	26,304	20,951	20,544	27,313
Gums	V	2,343	1,604	1,594	1,761	32,275
Resin	V	18,577	21,671	25,432	29,578	
Sandal-wood	V	11,119	9,954	9,984	9,984	— .

*Includes timber, round-wood and pump and matchwood.
**Includes firewood and charcoal wood, for the year 1966-67.

Imports and Exports : Exports and imports of forest products are quite negligible in the total foreign trade of the country. India imports mainly the major forest products like wood-lumber and cork, paper and paper waste, wood and cork manufacture, paper, paper-board and their manufacture. The main source of supply of teak wood is Burma while other types of wood are imported from U.S.A., Canada, U.K., Sweden and Finland. Paper and pulp products are imported mainly from Sweden, Norway, Australia and U.K. From among the major forest products, a large quantity of wood is also being exported which is primarily of the hard type such as sandal-wood and some derived products. Among derived products, paper and paper making materials are the important items.

Whereas imports consist predominantly of major products, exports are dominated by minor products. Exports of both major and minor products have gone up appreciably during the last few years and an aggressive export policy is being followed by the Government while every possible effort is also being made to cut on

imports. The object is that the present deficit in exports over imports should end as early as possible.

Forest Labour and Employment : Forests in India do not provide extensive employment. What is, however, important is that these activities are practised in such areas where opportunities of employment from other industries are very few. In 1949-50, on an average, 204.5 thousand persons per day were employed on a whole time basis, and 365 thousand per day on part time basis. Of the 204·5 thousand whole time employees 19.4 thousand were engaged in forest management, 129.4 thousand in forest extraction and 55.7 thousand in forest industries. About 75 per cent of the part time workers were employed in forest extraction. The number of these workers no doubt declined in subsequent years. It is, however, estimated that during 1970-71, forestry activities provided employment to about 3 million persons.

The tribal population living within or near forest areas is the major source for recruiting forest labour. The tribal population, the original settlers of the land, was driven to the forest by its sheer incapacity to adjust itself to the economic forces of a competitive economy. The tribal people forthrightness, loyalty, honesty and limited aspirations for material prosperity were exploited by unscrupulous and greedy persons. Those originally settled in forests enjoyed unrestricted rights to timber, for grazing cattle, fuel and for cultivation of land. Their rights were severely curtailed with the enunciation of the policy of conservation of forests. They could no longer practise zooming cultivation, and they did not possess the necessary skill for farming of cultivated lands. Forest lands are less fertile in most cases for growing crops. All these reasons led to dwindling incomes and increased poverty of the forest settlers. Forest labour then came to be a major opening to them to earn. Forest contractors often exploited the economic conditions of the tribal forest labour. The Scheduled Tribes Commission set up in April 1960, studied the economic conditions of tribals living in forest areas in nine important States. It observed that the special machinery to protect tribals against exploitation by outsiders had not worked satisfactorily. Lack of continuous employment and indebtedness were listed as two major problems. The commission recommended organization of forest labour co-operatives on the lines of those operating in scheduled areas of Maharashtra and Gujarat. The problem of indebtedness should receive immediate and more decisive attention. Regarding indebtedness, some ameliorative measures have been adopted in a few States. In Andhra Pradesh, for instance, the outstanding interest was discharged in January 1957. These measures are, however, not adequate.

Forest Labourers' Co-operative Societies : The idea of forming Forest Labourers' Co-operative Societies was first conceived for the Warli tribals of Thana district in the former Bombay State. This was subsequently developed into Forest Labourers' Co-operative Societies in 1945-46. Under this system, forest contracts, instead of being sold by auction are given on an agreed basis to the Forest Labour Co-operative. The forest labourers, besides earning wages as per the prescribed rates for different operations, also receive bonus and other facilities from the profits of the co-operative societies. The enthusiasm evinced by the tribals in working these societies can be seen from the spread of these societies over the large portion of the forest area in the former Bombay State.

A similar effort at prompting labourers' co-operatives was also made in Tamil Nadu. In 1950, the State Government appointed a team of experts to formulate plans for amelioration of the tribals and for the development of the Agency areas in the four districts of Srikakulam, Visakhapatnam, East Godavari and West Godavari. The team recommended a network of multi-purpose co-operative societies at different centres in the Agency areas with a view to eliminating exploitation by the money-lenders and traders. These societies would (i) purchase all the minor forest produce collected by the tribals, and would also buy marketable surplus of field crops, (ii) sell them their daily needs like kerosene oil, salt, spices, etc. and (iii) provide them easy credit facilities.

After the constitution of Andhra Pradesh, the State Government examined these suggestions, but it was found that the co-operative institutions functioning in the agency areas did not work satisfactorily among the tribals. The conclusion reached was that an institution under the control of the Government and catering to the needs of tribals was necessary. As a result, the Andhra Scheduled Tribes Co-operative Finance and Development Corporation was constituted on October 26, 1956, under the Madras Co-operative Societies Act, 1932 with its area of operation extending to the scheduled areas in the districts of Srikakulam, Visakhapatnam, East Godavari and West Godavari. The Corporation started functioning on April 5, 1957.

By end of June 1960, eight Primaries (Agency Produce Co-operative Marketing Societies) had been affiliated to the Corporation covering the entire tribal areas in Srikakulam and Visakhapatnam districts and parts of the tribal areas in the East Godavari district.

Forest Labour Co-operatives : In the National Forest Policy Resolution adopted by the Government of India in 1952, it was stated that no forest policy, however well-intentional and meticulously

drawn up, had the slightest chance of success without the willing support and co-operation of the people in the neighbourhood of the forests. It was stressed that intermediaries who exploited both the forest and the local labour for their own benefit might be supplanted gradually by forest labour co-operatives which might be formed to suit local conditions. Appreciable progress has since been made in the organization of such co-operatives particularly in Maharashtra and Gujarat. Their number now exceeds 1,200 and their work is valued at over Rs. 4.50 crores. In some States, public agencies such as Tribal Development Corporations have been set up with the object, among others, of promoting such co-operatives.

Forestry in The Fourth Plan : In forestry, there are three main objectives : increase productivity link up, forest development with various forest-based industries and to develop forests as a support to rural economy. As regards the first objective, it is necessary to stress that one of the problems of Indian forests is relatively low productivity. Forests occupy about 23 per cent of the land surface of the country and yet the contribution of forestry and logging in the net domestic product at current prices in 1967-68 was only 1.2 per cent. The average per hectare production per annum of forests in India is estimated at about 0.53 cubic metre as against the world average of 2 cubic metres. This is indicative of the size of the effort necessary in the coming years.

The immediate objective is to attain self-sufficiency in industrial and commercial timbers, in fuel wood and other forestry products required by consumers and the ancillary industries. This objective is proposed to be achieved (i) by increasing the area under man-made forests for the most efficient and economical utilization of space; (ii) by increasing productivity of existing forests through better logging techniques and tools; (iii) by improvement of communications so that hitherto untapped resources can be exploited; and (iv) by popularization of the use of secondary timber after proper seasoning and preservation treatment. Accordingly, activities under the various schemes, namely, (1) plantation of quick-growing species, (2) economic plantations for industrial and commercial uses, (3) rehabilitations of degraded forests, and (4) farm forestry-*cum*-fuel plantations, were intensified during the year. Development of communications was also accelerated to increase accessibility to the forests. As against 1.36 lakh hectares of man-made forests raised during 1969-70, 1.39 lakh hectares are likely to be planted with industrially important species during the year under review.

Emphasis is being laid during the Fourth Five Year Plan on measures to meet the immediate and long-term agricultural and

industrial requirements, since the demand for various forest products, timber, domestic fuel and raw materials for industries has rapidly increased. Consumption of industrial wood in 1968-69 is estimated at 11 million cubic metres, while the demand by 1973-74 is projected at 16 to 17 million cubic metres. It should be possible to increase the supply by 1973-74 to about 13.5 million cubic metres. To increase forest production, the Fourth Plan envisages further efforts at creating large scale plantations of valuable quick-growing species and species of economic and industrial importance. Intensive exploitation and rational utilization of existing forest resources will be aimed at. Concerted efforts at regenerating areas, where forest produce is removed for industrial uses will be taken. This is equally important for all forests where produce is to be utilized for new paper and other industrial projects. Steps will be taken to bridge the gap between demand and supply by fuller utilization of forest resources, other than wood, such as bamboos and grassized timber. The object is to achieve self-sufficiency in forest products as early as possible, specially for major forest-based industries such as pulp, paper, newsprint, wood panel products and matches so that the import of some of these items may be replaced and some sizeable exports of paper and wood panel products built up. In some States, there are inaccessible forests which have not yet been economically exploited. Communications will be provided in selected areas. In addition, in areas, which are already being exploited, improved methods of working, including reduction of wastage, will be introduced. The consolidation and scientific management of hitherto unorganized forests and protection against unregulated cutting, grazing and fire will be undertaken.

The basic principle of Government policy that minor forests, pastures and grazing grounds must be managed mainly in the interest of the population of the tract and particularly to serve their requirements of fuel and fodder, has long been recognized. However, efforts made in the past to achieve these aims have not proved successful. Unless adequate steps are taken early to protect trees and raise firewood plantations, a serious shortage of firewood is apprehended in rural areas, despite the availability of alternative fuel in some areas. Attempts have, therefore, to be made to formulate schemes for management of land resources lying between reserved forests and arable land to protect them from further deterioration, and to develop them as adjuncts to the rural economy, particularly for fodder and fuel. It will be necessary to plan for concerted action in this respect on the part of the forest, revenue, agriculture and animal husbandry departments in co-operation with village panchayats and *zila parishads.*

One of the new schemes will provide for co-ordinated research in forestry. This will be undertaken in close collaboration with the States under the overall guidance of the Forest Research Institute, Dehra Dun, and the Forest Research Laboratory at Bangalore. New regional research centres will be established at Gauhati and Jabalpur. The schemes of research mainly relate to plantation programmes and ecological studies. Attention will be given to collection of more comprehensive statistics.

The schemes of pre-investment survey of forest resources will be extended to 75,000 sq. km. of forest areas. The project for training forest officers and the field staff of forest labourers' co-operative societies and of forest contractors in the use of basic logging tools and on the planning of logging operations will be continued.

TABLE XLI

Financial *Vis-a-Vis* Physical Achievements of Selected Schemes

Schemes	*1st Plan (1951-56)*	*2nd Plan (1956-61)*	*3rd Plan (1961-66)*	*Post/Third (1966-69)*	*Base Level (1968-69)*	*Leven anticipated (1973-74)*
1	2	3	4	5	6	7
Plantation schemes						
Quick growing species						
F	—	—	38.0	80.9	—	—
P	—	—	84.8	160.8	245.6	813.4
Economic Plantation						
F	13.7	68.4	112.0	96.4	—	—
P	50.0	217.4	239.9	153.9	661.1	1,076.3
Farm Forestry						
F	—	—	20.0	20.5	—	—
P	—	—	91.0	43.1	134.0	209.0
Communications						
F	4.2	24.8	55.6	32.6	—	—
P	6.8	16.4	17.3	4.0	44.4	58.4
Nature conservation						
F	—	9.8	17.5	11.9	—	—
P	—	—	—	—	2,010.7	2,198.7

F=Stands for financial achievement in million rupees.

P=Stands for physical achievement in thousand hectares in respect of plantation schemes and thousand kilometres in the scheme of communications.

Forest Policy : The beginning of scientific forestry in India may be reckoned with the appointment of an Inspector General of Forests in 1863. The forest management was to aim at :

1. retaining under forests whatever forest areas happened to be available at the time,
2. protecting such areas against misuse by the people,
3. maintaining them under proper silvicultural treatment,
4. limiting timber removals to what would be permissible under sustained yield principles, and
5. improving the forest crop by artificial cultivation.

A regular forest policy on these lines could not, however, be laid down earlier than 1894. The Royal Commission on Agriculture also made certain recommendations with a view to increasing the utility of forests as follows :

1. Appointment in each province of a forest utilization officer, whose main function should be to develop forest industries.
2. A reclassification of forest areas into a major division in charge of commercial forests and those necessary on physical and climatical grounds, and a minor division in charge of minor forests, fuel plantations, village woodlands and waste lands.
3. Transfer of wooded areas then under the control of Forest Department to village management through properly elected committees or panchayats on the lines adopted by the then Madras Government.
4. Institution of short courses at the agricultural colleges for all newly recruited forest officers to foster a closer touch between the Agricultural and Forest Departments.

No concrete steps were taken by Government to implement these recommendations. Forests being an important source of revenue in many States, there is often a tendency to overfelling, ignoring the needs of sound management. Sometimes a programme of expanding forests clashes with the needs of agriculture and animal husbandry. These problems only underline the importance of a proper land use survey in which side by side with technical and economic consideration of land capability, due consideration should be shown to the local needs as well. Further, forests being a State subject, there is need for a sound management policy, and its implementation as well as co-ordination with the State programmes.

The Central Board of Forestry was set up in 1950, to implement the policy of development. The annual celebrations of *Van Mahotsava* (Forest Festivals) were also instituted simultaneously. *Van Mahotsava* aims at making the people conscious of the importance of

forests and urging them to contribute their share in preserving and developing the forest resources of the country.

Many changes have taken place since then in the pattern and extent of demand for forest produce. The protective functions of forests have been recognized. This necessitated a revision in the forest policy. The Government of India declared its new policy in 1952. The National Forest Policy as it was called, was formulated on the basis of six paramount needs of the country as detailed below :

1. The need for evolving a system of balanced and complementary land use under which each type of land is allotted to that form of use under which it would produce most and deteriorate least.
2. The need for checking :
   (a) the denudation in mountainous regions, on which depends the perennial water supply of the river system, whose basins constitute the fertile core of the country ;
   (b) the erosion progressing apace along the treeless banks of the great rivers leading to ravine formation and on vast stretches of undulating wastelands depriving the adjoining fields of their fertility ; and
   (c) the invasion of sea sands on coastal tracts and the shifting of sand dunes, more particularly in the Rajasthan desert.
3. The need for establishing tree lands, wherever possible, for the amelioration of physical and climatic conditions promoting the general well-being of the people.
4. The need for ensuring progressively increasing supplies of grazing, small wood for agricultural implements and, in particular, of firewood to release the cattle dung for manure to step up food production.
5. The need for sustained supply of timber and other forest produce required for defence, communications and industry.
6. The need for the realization of the maximum annual revenue in perpetuity consistent with the fulfilment of the need enumerated above.

These vital needs actually indicate the functions the forests are to perform and provide the fundamental basis of the policy governing their future.

In brief, the policy aims at evolving an efficient management and progressive development of forests. As a target to be achieved over a period, it was decided to raise the area under forests to one-third of the total geographical area.

The immediate objective of forestry development is to attain self-sufficiency in industrial and commercial timbers, in fuel wood and other forestry products required by consumers and ancillary industries. This objective is proposed to be achieved (i) by increasing the area under man-made forests for most efficient and economical utilization of space ; (ii) by increasing productivity of existing forests through better logging techniques and tools ; (iii) by improvement of communications so that hitherto untapped resources can be exploited; and (iv) by popularization of the use of secondary timbers after proper seasoning and preservation treatment. Accordingly, activities under the various schemes, namely, (1) plantation of quick-growing species, (2) economic plantation for industrial and commercial uses, (3) rehabilitation of degraded forests, and (4) farm forestry-*cum*-fuel plantations were intensified during the year. Development of communications was also accelerated to increase the accessibility to forests. As against 1.36 lakh hectares of man-made forests raised during 1969-70, 1.39 lakh hectares are likely to be planted with industrially important species during the year under review.

The growing industrial and economic development needs of the country have necessitated the maximum exploitation of forest resources. Measures for raising productivity and setting up man-made forests on a large scale to meet country's demand for raw materials are being intensified, with special emphasis being laid on raising plantations of fast growing species and other valuable commercial species, rehabilitation of degraded forests, better extraction techniques, improvement of forest communications and popularizing the secondary species of timber after proper seasoning and preservative treatment.

The Centrally sponsored project for "pre-investment survey of forest resources", has thus been in operation since 1965, with assistance from the United Nations Special Fund for investigating the economic availability of raw materials for the development of wood-based industries in the northern, central and southern zones, covering a total area of about 3 million hectares. Under this project, good progress has been made in assessing the raw material availability and possibility of development of wood-based industries in these areas. During the year 1968-69, small and large scale aerial photographs were taken in various zones. Field work on forest inventory has been almost completed in the southern zone. Besides, field manuals for the north and south zones and manuals for industrial plantations and species, elimination trials, investigations on costs and methods, etc. have been prepared.

APPENDIX

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Geographical Area*	*Total Forest Area*	*Classification of Forest*					
				Type of Forests		*Legal Status*			
				Merchantable	*Unprofitable or inaccessible*	*Reserved*	*Protected*	*Unclassed*	*Coniferous (Soft wood)*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	1963-64	275,244	64,719	50,824	13,895	42,168	17,736	4,815	—
	1964-65		64,504	50,824	13,680	42,168	17,736	4,600	—
Assam	1963-64	121,973	45,258(b)	45,130(b)	128	16,166	11	29,081(b)	15
	1964-65		45,258(b)	45,130(b)	128	16,166	11	29,081(b)	15
Bihar	1963-64	174,008	31,460	21,325	10,135	4,087	25,869	1,504	—
	1964-65		31,427	21,325	10,102	4,113	25,851	1,463	—

N.A.—Not available.

(a) —Included under the head "Forest Department".

(b) —Includes forest area of 20,337 sq. kilometres under autonomous district council.

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Area according to Composition*				*Area according to Ownership*			*Percentage of Col. (3) to Col. (2)*
		Non-coniferous (Hard wood)				*Civil Authorities*	*Corporate Bodies*	*Private Individuals*	
		Sal	*Teak*	*Miscella-neous*	*Forest Deptt.*				
(10)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Anchra Pradesh	1963-64	8	15,732	48,979	64,719	—	—	—	23.5
	1964-65	8	15,732	48,764	64,504	—	—	—	23.4
Assam	1963-64	—	—	45,243(b)	24,921	—	20,337(b)	—	37.1
	1964-65	—	—	45,243(b)	24,921	—	20,337(b)	—	37.1
Bihar	1963-64	22,373	—	9,087	3,416	44	—	—	18.1
	1964-65	22,372	—	9,055	31,383	44	—	—	18.1

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometre)

State/Union Territory and Year		*Geographical Area*	*Total Forest Area*	*Classification of Forest*					
				Type of Forests		*Legal Status*			
				Merchantable	*Unprofitable or inaccessible*	*Reserved*	*Protected*	*Unclassed*	*Coniferous (Soft wood)*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gujarat	1963-64	187,091	17,946	17,946	—	6,374	1,277	10,295	—
	1964-65		18,660	18,470	190	6,540	2,130	9,990	—
Jammu and Kashmir	1963-64	222,870	21,079	8,496	12,583	(e)	(e)	(e)	19,340
	1964-65		20,362(d)	8,496	11,866(d)	(e)	(e)	(e)	19,340
Kerala	1963-64	38,869	10,435	7,273	3,162	8,228	475	1,732	—
	1964-65		10,419	7,271	3,148	8,225	475	1,719	—
Madhya Pradesh	1963-64	443,459	171,609	144,133	27,496	75,933	90,992	4,684	—
	1964-65		171,609	144,113	27,496	75,933	90,992	4,684	—

(c) —Includes an area of 4,266 sq. kilometres in the year 1963-64 and 3, 875 sq. kilometres in 1964-65 for which details according to type of forests are not available.

(d) — Excludes an area of 717 sq. kilometres for rak-hs and games reserved land.

(e) —Excluding Jammu and Kashmir for which break-up is not available. The legal classification of forest in vogue in Jammu and Kashmir State is "Demarcated", "Partially demarcated" and "Undemarcated."

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Area according to Composition*				*Area according to Ownership*			*Percentage of Col. (3) to Col. (2)*
		Non-coniferous (Hard wood)							
		Sal	*Teak*	*Miscella-neous*	*Forest Deptt.*	*Civil Authorities*	*Corporate Bodies*	*Private Individuals*	
(10)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Gujarat	1963-64	—	10,834	7,112	15,892	23	—	2,031	9.6
	1964-65	—	10,610	8,050	16,510	(a)	—	2,150	10.0
Jammu and Kashmir	1963-64	—	—	1,739	21,079	—	—	—	9.5
	1964-65	—	—	1,022	20,362	—	—	—	9.1
Kerala	1963-64	—	1,158	9,277	8,849	—	—	1,586	26.8
	1964-65	—	1,158	9,261	8,833	—	—	1.586	26.8
Madhya Pradesh	1963-64	21,554	28,464	121,591	171,609	—	—	—	38.7
	1964-65	21,554	28,464	121,591	171,609	—	—	—	38.7

APPENDIX *(Contd.)*

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Geographical Area*	*Total Forest Area*	*Classification of Forest*					
				Type of Forests		*Legal Status*			
				Merchantable	*Unprofitable or inaccessible*	*Reserved*	*Protected*	*Unclassed*	*Coniferous (Soft wood*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Madras (Tamil Nadu)	1963-64	129,966	22,220	14,230	7,990	17,240	3,830	1,150	—
	1964-65		22,220	14,230	7,990	17,240	3,830	1,150	—
Maharashtra	1963-64	307,269	67,599	38,487	29,112(c)	40,492	16,944	10,163	—
	1964-65		67,094	38,290	28,804(c)	40,267	16,933	9,894	—
Mysore (Karnataka)	1963-64	191,757	36,848	31,160	5,688	28,500	2,868	5,480	—
	1964-64		35,220	26,150	9,070	29,120	5,690	410	—
Orissa	1963-64	155,860	66,643	56,291	10,352	23,404	7,928	35,311	—
	1964-65		68,160	56,830	11,330	23,590	6,440	38,130	—
Punjab	1963-64	122,010	12,743	6,927	5,816	584	9,281	2,878	4,822
	1964-65		17,850(f)	6,920	10,930(f)	614	14,211	3,025	4,800
Rajasthan	1963-64	342,267	38,257	38,257	—	11,181	18,047	9,029	—
	1964-65		38,477	38,477	—	10,995	18,278	9,204	—

(f) —An increase in the area as compared to previous year is due to the inclusion of 5,085 sq. kilometres mostly unculturable in Lahul and Spiti Forest Division.

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Area according to*				*Area according to*			*Percentage of Col. (3) to Col. (2)*
		Composition				*Ownership*			
		Non-coniferous (Hard wood)							
		Sal	*Teak*	*Miscellaneous*	*Forest Deptt.*	*Civil Authorities*	*Corporate Bodies*	*Private Individuals*	
(10)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Madras (Tamil Nadu)	1963-64	—	780	21,440	21,070	(a)	N.A.	1,150	17.1
	1964-65	—	780	21,440	21,070	(a)	N.A.	1,150	17.1
Maharashtra	1963-64	—	17,026	50,573	56,721	6,514	10	4,354	22.0
	1964-65	—	18,456	48,638	56,768	6,353	10	3,963	21.8
Mysore (Karnataka)	1963-64	—	10,005	26,843	31,194	3,846	231	1,577	19.2
	1964-65	—	10,000	25,220	31,950	(a)	400	2,870	18.4
Orissa	1963-64	36,777	530	29,336	66,433	—	—	210	42.8
	1964-65	38,300	570	29,290	67,950	—	—	210	43.7
Punjab	1963-64	47	—	7,874	10,291	3	25	2,424	10.4
	1964-65	47	—	13,003	15,366	—	25	2,459	14.6
Rajasthan	1963-64	—	5,180	33,077	38,257	—	—	—	11.2
	1964-65	—	5,180	33,297	38,477	—	—	—	11.2

APPENDIX

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Geographical Area*	*Total Forest Area*	*Classification of Forest*					
				Type of Forests		*Legal Status*			
				Merchantable	*Unprofitable or inaccessible*	*Reserved*	*Protected*	*Unclassed*	*Coniferous (Soft wood)*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Uttar Pradesh	1963-64	294,366	46,692	31,787	14,905(g)	26,154	1,898	18,640(h)	12,359
	1964-65		46,641	31,787	14,854(g)	26,008	1,886	18,747(g)	12,530
West Bengal	1963-64	87,676	11,803	11,034	769	6,996	4,159	648	91
	1964-65		11,810	11,190	620	7,000	4,100	710	90
Andaman & Nicobar Islands	1963-64	8,293	6,055	5,330	725	2,435	3,434	186	—
	1964-65		6,055	5,330	725	2,434	3,621	—	—
Dadra Nagar Haveli	1963-64	489	..... Non-reporting						
	1964-65								

(g) —Includes an area of 8,583 sq. km. in the year 1963-64 and 5,496 sq. km. in 1964-65 for which details are not avaiable.

(h) Includes an area of 10,176 sq. km. for which seperate break-up into Reserved, Protected and Unclassed are not available.

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Area according to*				*Area aecording to*			*Percentage of Col. (3) to Col. (2)*
		Composition				*Ownership*			
		Non-coniferous (Hard wood)				*Civil Authorities*	*Corporate Bodies*	*Private Individuals*	
		Sal	*Teak*	*Miscella-neous*	*Forest Deptt.*				
(10)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Uttar Pradesh	1963-64	6,351	132	27,850	35,079	9,855	1,593	165	15.9
	1964-65	7,402	210	26,499	35,030	9,681	1,764	166	15.8
West Bengal	1963-64	4,706	10	6,996	11,536	148	70	49	13.5
	1964-65	4,700	20	7,000	11,690	(a)	70	50	13.5
Andaman & Nicobar Islands	1963-64	—	18	6,037	6,055	—	—	—	73.0
	1964-65	—	—	6,055	6,055	—	—	—	73.0
Dadra Nagar Haveli	1963-64	.....	.....	.....Non-reportihg.....		.....	.....		
	1964-65								

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

Union/Territory State and Year		*Geographical Area*	*Total Forest Area*	*Classification of Forest*					
				Type of Forests		*Legal Status*			
				Merchantable	*Unprofitable or inaccessible*	*Reserved*	*Protected*	*Unclassed*	*Coniferous (Soft wood)*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Delhi	1963-64	1,483	53	32	21	7	14	32	—
	1964-65		53	32	21	7	14	32	—
Goa, Daman and Diu	1963-64	3,733	1,050	930	120	1,050	—	—	—
	1964-65		1,050	930	120	1,050	—	—	—
Himachal Pradesh	1963-64	28,195	11,177	9,022	2,155	1,508	7,237	2,432	7,310
	1964-65		12,520	9,161	3,359	1,509	9,498	1,513	8,239
Laccadive Minicoy & Amindivi Islands	1963-64	28	—	—	—	—	—	—	—
	1964-65		—	—	—	—	—	—	—
Pondicherry	1963-64	473	—	—	—	—	—	—	—
	1964-65		—	—	—	—	—	—	—

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Area according to Composition*				*Area according to Ownership*			*Percentage of Col. (3) to Col. (2)*
		Non-coniferous (Hard wood)				*Civil Authorities*	*Corporate Bodies*	*Private Individuals*	
		Sa	*Teak*	*Miscella-neous*	*Forest Deptt.*				
(10)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Delhi	1963-64	—	—	53	12	6	35		3.6
	1964-65	—	—	53	12	6	35		3.6
Goa, Daman and Diu	1963-64	—	—	1,050	1,050	—	—	—	28.2
	1964-65	—	—	1,050	1,050	—	—	—	28.2
Himachal Pradesh	1963-64	319	—	3,548	10,036	—	2	1,139	39.6
	1964-65	318	—	3,963	11,379	—	2	1,139	44.4
Laccadive Minicoy & Amindivi Islands	1963-64	—	—	—	—	—	—	—	—
	1964-65	—	—	—	—	—	—	—	—
Pondicherry	1963-64	—	—	—	—	—	—	—	—
	1964-65	—	—	—	—	—	—	—	—

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

Union/Territory	*State and Year*	*Geographical Area*	*Total Forest Area*	*Classification of Forest*					
				Type of Forests		*Legal Status*			
				Merchantable	*Unprofitable or inaccessible*	*Reserved*	*Protected*	*Unclassed*	*Coniferous (Soft wood)*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Manipur	1963-64	22,346	6,022	3,652	2,370	1,005	2,220	2,797	907
	1964-65		5,990	2,910	3,080	530	1,580	3,880	900
Nagaland	1963-64	16,488	2,660	1,370	1,290	300	520	1,840	230
	1964-65		2,630	1,370	1,260	300	520	1,810	230
N.E.F.A.	1963-64	81,426	48,620	48,620	—	9,250	—	39,370	—
	1964-65		48,620	48,620	—	9,250	—	39,370	—
Tripura	1963-64	10,451	6,353	2,211	4,142	4,114	2,239	—	—
	1964-65		6,353	2,208	4,145	4,122	2,231	—	—
All-India	1963-64	3,268,290	747,310	594,447	152,854	327,176(e)	216,979(e)	182,067(e)	45,074
	1964-65		752,982	590,064	162,918	327,181(e)	226,027(e)	179,412(e)	46,144

APPENDIX (*Contd.*)

Classification of Forest Area

(Sq. Kilometres)

State/Union Territory and Year		*Area according to Composition*				*Area according to Ownership*			*Percentage of Col. (3) to Col. (2)*
		Non-coniferous (Hard wood)				*Civil Authorities*	*Corporate Bodies*	*Private Individuals*	
		Sa	*Teak*	*Miscellaneous*	*Forest Deptt.*				
(10)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Manipur	1963-64	—	36	5,079	3,225	2,797	—	—	26.9
	1964-65	—	40	5,050	5,990	(a)	—	—	26.8
Nagaland	1963-64	130	—	2,300	850	—	1,810	—	16.1
	1964-65	130	—	2,270	850	—	1,780	—	15.9
N.E.F.A.	1963-64	2,560	—	46,060	48,470	—	150	—	59.7
	1964-65	2,560	—	46,060	48,470	—	150	—	59.7
Tripura	1963-64	422	1	5,930	6,353	—	—	—	60 8
	1964-65	427	2	5,924	6,353	—	—	—	60.8
All-India	1963-64	95,247	89,906	517,074	685,117	23,236	24,263	14,685	22.9
	1964-65	97,818	91,222	517,798	696,582	16,084	24,573	15,743	23.0