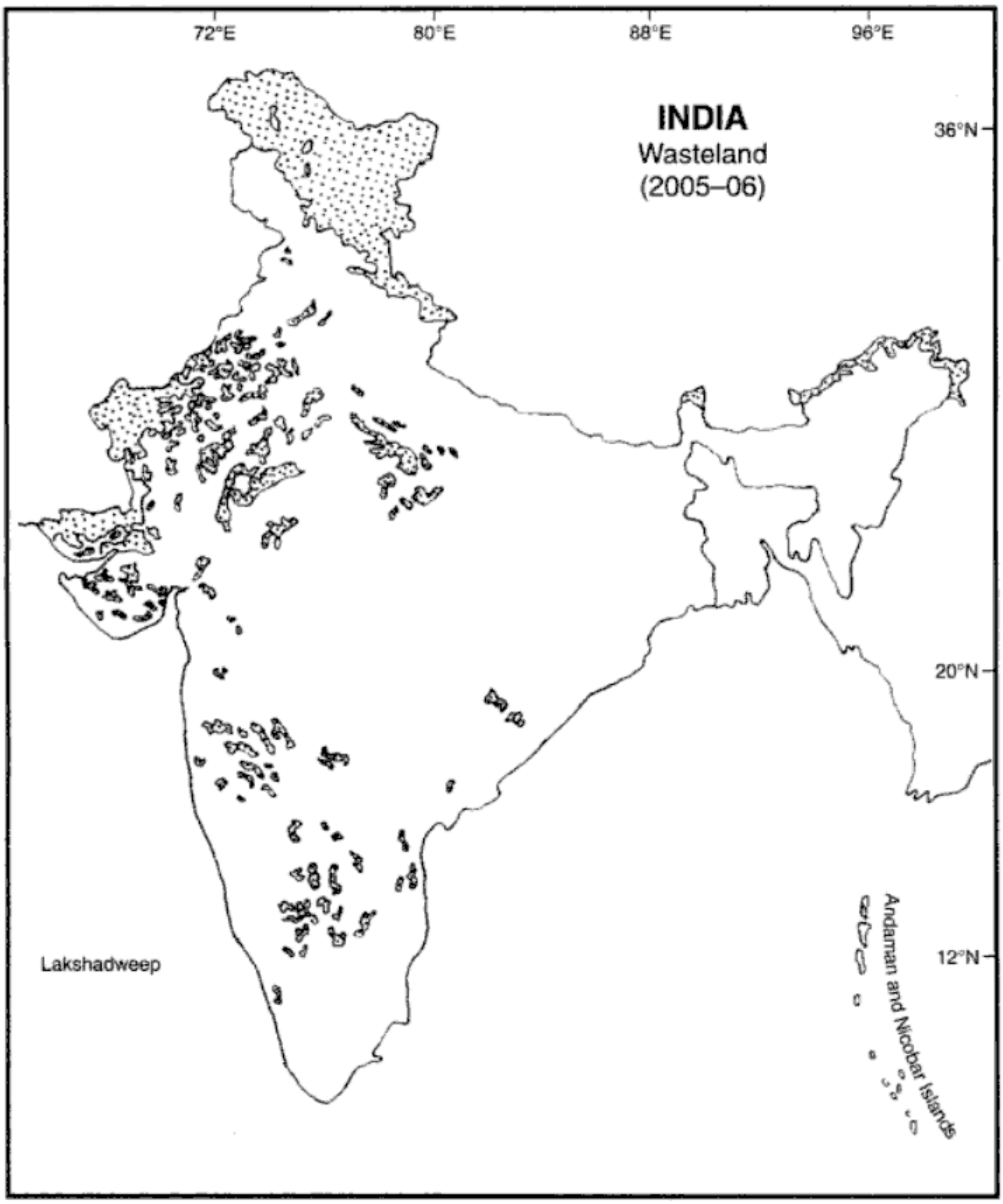

Fig. 9.3 Wasteland (2005–06)

Table 9.2 Waste Lands and Degraded Lands

Type of land	*Percentage*
Gullied land	2.05
Land with or without scrub	19.40
Water-logged and marshy land	1.66

(*Contd.*)

Table 9.5 *International Comparison of Yield of Wheat, 2004–05, (in metric tonnes/hectare)*

Country	*Yield*	*Rank*
UK	7.7	1st
France	7.58	2nd
China	4.25	3rd
India	2.71	4th
Pakistan	2.37	5th
Iran	2.06	6th
Australia	1.64	7th
World	2.87	

Source: ***Economic Survey 2006–07***, p.160

14. Government Policy

After the First Five-Year Plan, Indian agriculture got a step-motherly treatment. The farming community has been ignored, while there has been more emphasis on industrialisation and urbanisation. The growth rate of agriculture is only about 2.5 per cent, while the overall growth rate of the country is about 9 per cent (2008). The farmers are not getting remunerative prices, most of them are under debts and in several parts of the country, farmers are committing suicides. This dismal picture is the result of continuous careless agricultural land use planning. Much emphasis has however, been laid on the rural and agricultural development in the Eleventh Five-Year Plan to remove the rural, urban inequality. Creation of 580 lakh jobs has also been proposed in this plan to overcome the problem of unemployment and to check the rural-urban migration. The real challenge for the government is in trying to boost food output at home, and increase investment in rural and agricultural infrastructure for the same, while at the same time not letting its guard down on fiscal prudence or inflation management. The severe drought of 2009 over greater part of the country has increased the miseries of the farmers, which is a set-back in the revival of Indian economy.

15. Lack of Definite Agricultural Land Use Policy

In the absence of a definite land use policy, the farmers grow crops according to their convenience. This sometimes leads to excess of production and sometimes scarcity. Many a times the farmers have to burn their sugarcane crop and often get less remunerative price of vegetables (onion, and other vegetables).

16. Lack of Marketing and Storage Facilities

Lack of marketing and storage facilities and the role of brokers deprive the farmers to fetch remunerative prices for their agricultural products. Except a few states like Punjab, Haryana, Maharashtra, Gujarat, and Andhra Pradesh, marketing and storage facilities are inadequate. In greater part of the country, farmers are still at the mercy of unscrupulous traders and are easily exploited by secret brokerage, false weights and payment of inflated commissions. Moreover, due to lack of proper pricing policy, farmers fail to obtain fair price for their agricultural produce.

17. Low Status of Agriculture in the Society

In greater parts of India, agriculture is not considered as a dignified and honourable profession.

(i) Land Tenure and Land Tenancy

The ownership of agricultural land is determined by the law of land tenure and land tenancy. In the primitive societies like those of the shifting cultivators (*Jhumias*), land belongs to the community. Subsequently, in India, the land ownership rights were vested in the king and the government. During the British period, a new system of land tenancy known as *Zamindari, Mahalwari,* and *Royatwari* was introduced to manage the agricultural land and to collect the land revenue. After independence, the Zamindari system was abolished and the rights of the tillers over cultivated land were restored.

After the abolition of Zamindari system, a number of land reform legislations have been passed by the central and state governments, but still there is enough scope to restore the rights of the actual tillers and landless labourers. Still, there are numerous absentee landlords, many of them possessing land more than the ceiling act permits. Only Punjab, Haryana, and Uttar Pradesh are the states in which consolidation of holdings has been completed.

(ii) Land Holding

In India the size of holding is too small. Due to the rapid growth of population during the last few decades and the existing law of inheritance, the agricultural land is divided equally among the male children of the deceased farmer. At present, the per capita available land is only about 0.10 hectare which is much below the world average of about 4.50 hectares. Over 75 per cent of the land holdings are less than one hectare. Such small holdings are not economically viable. In fact, small holdings can not produce enough to meet the costs of irrigation, improved seeds, chemical fertilisers, insecticides, pesticides and farm machinery. The average size of holdings and their percentage share in India have been given in the **Table 9.6 (Fig. 9.5).**

Table 9.6 *The Average Size of Land Holdings in the Selected States of India, 2005*

State	*Size of holdings (hectares)*	*State*	*Size of holdings (hectares)*
Rajasthan	4.00	Himachal Pradesh	1.15
Maharashtra	2.40	Bihar	0.70
Gujarat	2.85	Assam	1.15
Madhya Pradesh	2.75	Tamil Nadu	0.85
Haryana	2.45	West Bengal	0.80
Karnataka	2.15	Uttar Pradesh	0.72
Punjab	3.45	Jammu & Kashmir	0.75
Andhra Pradesh	1.50	Kerala	0.30
Orissa	1.30	India	1.50

Source: ***Agricultural Statistics of India, 2005.***

An examination of **Table 9.6** shows that the average size holding in India is about 1.50 hectares which is too small for mechanisation and application of modern technology. The largest size of operation holdings is in Rajasthan being 4.00 hectares, followed by Punjab at 3.45 hectares, and Gujarat at 2.85 hectares. The lowest size of land holding is in Kerala, being only 0.3 hectares and Uttar Pradesh 0.72 hectares. In rest of the states, it varies between 0.8 to 2.50 hectares. On the whole, in most of the states, the size of holdings is not economically viable.

the states of the country. There are many hurdles in the implementation of consolidation of holdings in some of the states. Some points which are coming in the way of implementation of consolidation of holdings are as under.

1. Farmers are emotionally attached to their ancestral land, and therefore, they are not willing to take advantage of the scheme of consolidation of holding.
2. Those farmers who own good quality of land do not like the scheme for fear of getting the inferior and poor quality of land after the consolidation.
3. Consolidation of holdings is a cumbersome process. The government officials who implement the scheme are generally slow and often corrupt.
4. In general, the scheme did not receive the desired support and co-operation from the farmers.
5. The scheme has paved way for litigation and court cases, many of which are pending in different courts for a long time. This vitiates the serene atmosphere of the rural areas.
6. Under the existing law of inheritance, the fields continue to be smaller and fragmented.
7. In every consolidation, about 5 to 10 per cent of the village land is taken out for providing house sites to the weaker sections of society, approach roads (*chak-roads*) and village utility services. Hence, if the process is repeated three or four times, a sizable portion of the agricultural land would go out of agriculture.
8. The cost of consolidation is realised from the farmers which has adverse effect on their resources and economy.
9. It has been observed that the small farmers are generally allotted inferior quality of land, and due to lack of money power, they are neither able to please the officials nor get justice in the court.

Looking at these drawbacks, efforts should be made to remove these barriers and pitfalls in the scheme of consolidation of holdings to modernise the system of keeping revenue records. In the Seventh Five-Year Plan emphasis was laid on (i) scientific survey of the un-surveyed land, (ii) registering the name of tenant and share cropper in land records, (iii) strengthening the revenue system at the lowest level, and (iv) providing training facility to revenue officials to improve their efficiency. During the Eighth Five-Year Plan, it was decided to use computer and new techniques for keeping and maintaining revenue records.

Thus, a number of legislations have been enacted in the country for land reforms after independence, but due to socioeconomic and cultural complexities, loopholes in the land reform laws, laxity in implementation, and political and legal interference, these land reforms have not been able to achieve the desired success.

INFRASTRUCTURE AND AGRICULTURAL INPUTS

Provision of quality and efficient infrastructure is essential to realise the full potential of agriculture. In other words, infrastructural development is imperative for the agricultural development of a country/region. Infrastructure includes the facilities of irrigation, availability of electricity, roads, marketing credit facilities and crop insurance.

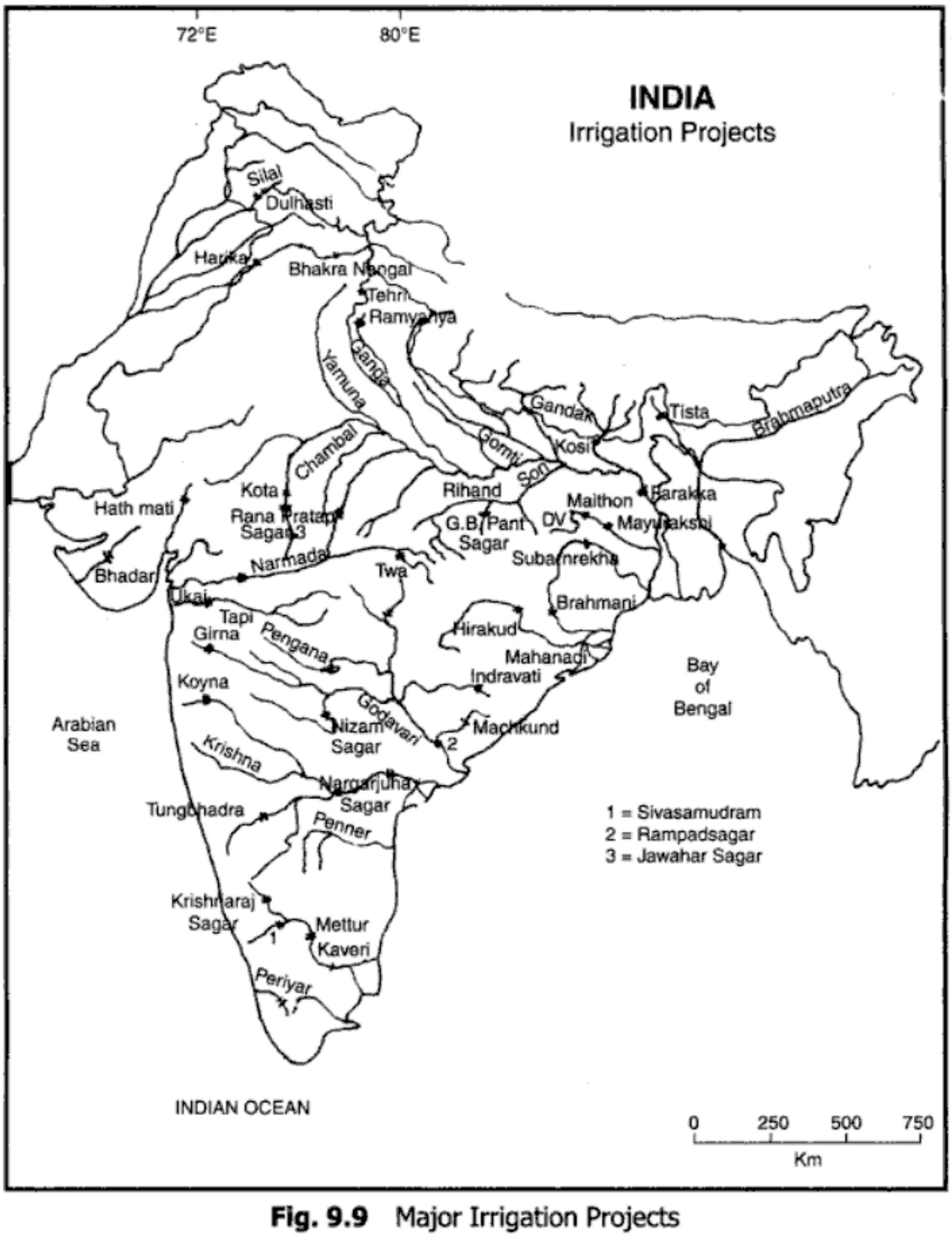

Fig. 9.9 Major Irrigation Projects

2. Availability of Chemical Fertilisers

The natural fertility of the soil decreases with the passage of time. In a region like the Great Plains of India, in which agriculture is being carried out for the last five thousand years, the soils are generally depleted and are increasingly losing their resilient characteristics. For the recuperation of fertility, the soils need to be rested in the form of fallowing or they have to be enriched by applying manures (cowdung, compost, and green) and chemical fertilisers.

The High Yielding Varieties give rise to short stemmed, stiff-straw plants that respond well to heavy doses of fertilisers. These dwarf varieties are known as the hungry varieties which need more energy in the form of chemical fertilisers. Contrary to this, the traditional varieties, if given heavy doses of fertilisers, get lodged at the occurrence of rains. The lodging of the crop reduces the yield per unit area.

In the areas of controlled irrigation, the recommended dose of chemical fertiliser for the new seeds of wheat and rice in terms of NPK is 90-45-45 kg. per hectare. Some of the well off farmers of Punjab, Haryana, and western Uttar Pradesh are applying the chemical fertilisers to the crop in the prescribed quantity.

3. Plant Protection Chemicals

The new seeds are very delicate and highly susceptible to pests and diseases. The irrigated fields enriched with heavy energy input (fertilisers-NPK) create a micro climate (hot and humid) in the field which helps in the fast growth of plants. The same environment is conducive for the fast growth and multiplication of insects and pests. These insects and pests attack the crop, hamper their growth and reduce the yield substantially. The danger of pests and insects may be reduced by using plant protection chemicals. The problem may be tackled either by developing the disease resistant seeds or by spraying insecticides and pesticides at the appropriate time prescribed or advised for different crops.

The problems of crop disease and pests may also be tackled by timely application of insecticides and pesticides. Thus, the farmer must have adequate knowledge of plant disease and their controlling chemicals. At the outbreak of a disease in the crop, the entire area should be sprayed. If the timely spray of the insecticides and pesticides is not done, the crop of the entire village/region may vanish. Since the plant protection chemicals are quite expensive, they are generally out of reach of the small and marginal farmers. And if the crops by small and marginal farmers are not sprayed, the insects may creep in the neighbouring fields and the disease may adversely affect the larger area.

4. Capital Constraint

Availability of capital is also a vital constraint in the adoption and successful cultivation of the High Yielding Varieties. The farmer must have sufficient capital for the purchase of seeds, installation of tube-wells, drilling of pumping sets, chemical fertilisers, plant protection chemicals, tractors, harvesters, threshers, sprayers, and other accessories of agriculture. In case the farmer does not possess the operational capital, he should have an easy access to credit. In India, most of the farmers have no surplus over consumption, and therefore, no saving or operational capital at their disposal. The agrarian institutions like banks and co-operative credit societies have great responsibilities. They should advance loans to the farmers at a reasonable rate of interest. Unfortunately, the credit agencies in India, generally, serve the big farmers who are economically well off and

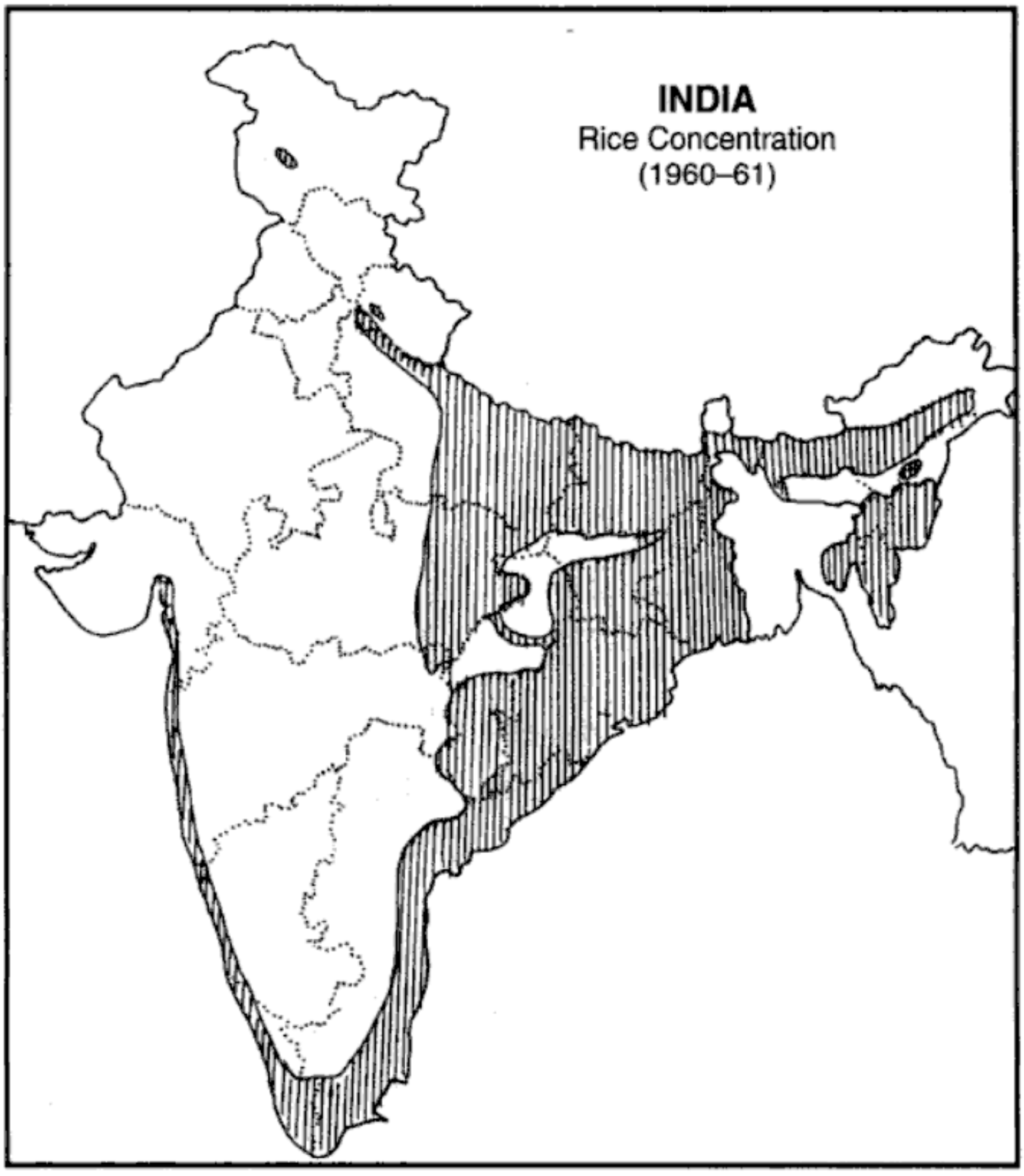

Fig. 9.10 Rice Concentration (1960–61)

Table 9.10 *Cropping Pattern in 2005–06*

Crops	*Area in million hectares*	*Percentage*
Rice	45.0	26.43
Wheat	27.4	16.10
Jowar	10.4	6.11
Bajra	8.8	5.16
Maize	6.4	3.76
Gram	6.3	3.70
Pulses	21.1	12.40

Source: ***Government of India, Ministry of Information: Production Division***, India (2007), New Delhi, pp. 388–389.

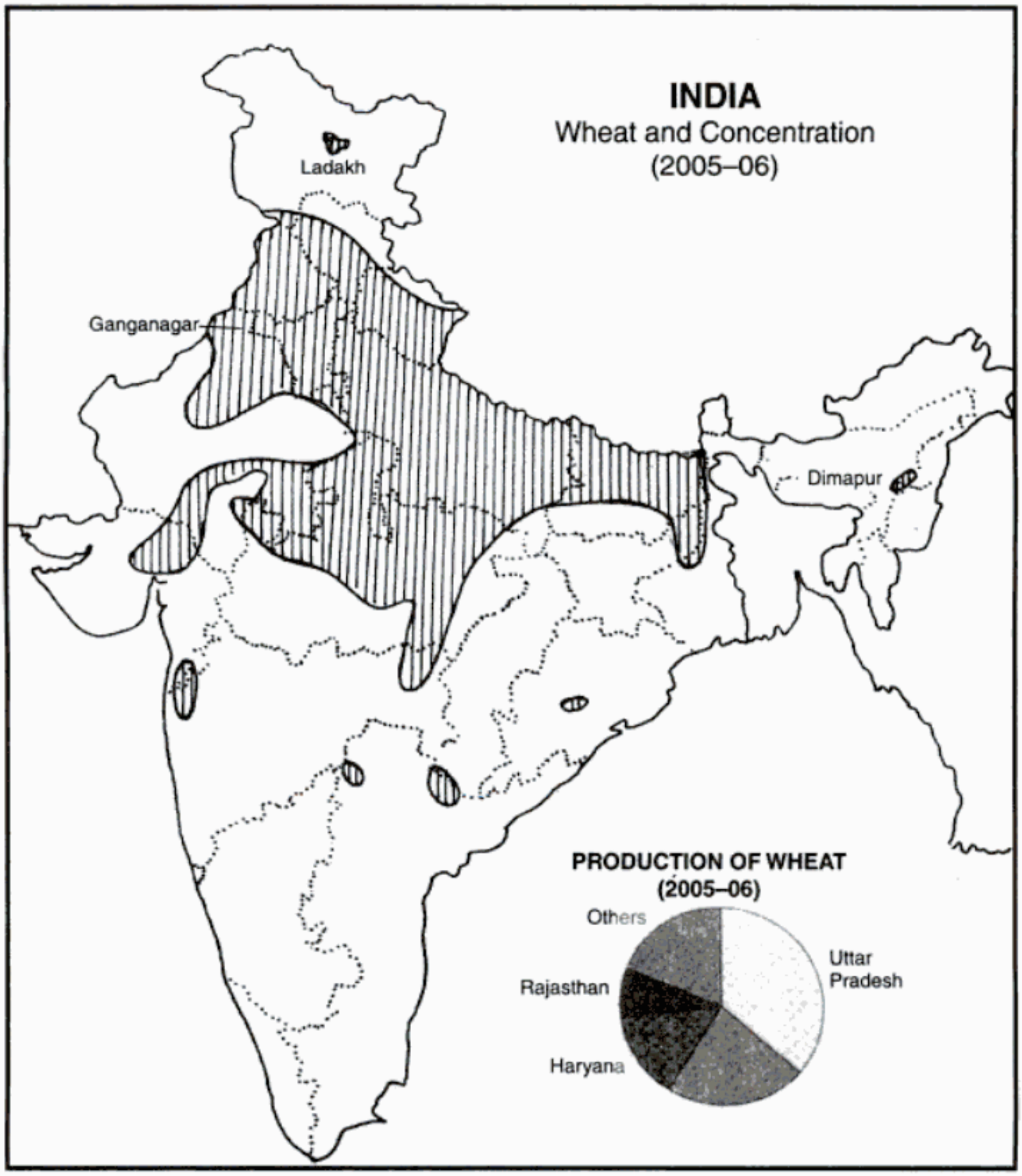

Fig. 9.13 Wheat Concentration (2005–06)

Table 9.12 *Traditional Rotation of Crops (1960–65) in Banhera (Tanda), District Hardwar*

Year	*Kharif Season (Mid-June to Mid-October)*	*Rabi Season (Mid-October to Mid-April)*	*Zaid Season (April-June)*	*No. of days land left fallow*
1960	Millet/fodder/rice	Gram	Fallow	90
1961	Fallow	Wheat	Fallow	210
1962	Millet/fodder/rice	Gram	Fallow	90
1963	Fallow	Wheat	Fallow	210
1964	Millet/fodder/rice	Gram	Fallow	90
1965	Fallow	Wheat	Fallow	210

Source: ***Field work by the author,*** 1960–65.

who are economically well off and politically powerful. The big farmers could easily pre-empt for their own use the bulk, if not, the entire supply of costly inputs like electricity, water, fertilisers, insecticides, and pesticides. Thus, the poor farmers have been deprived of enough inputs so essential for the successful cultivation of the High Yielding Varieties of crops.

Tenant Farmers

The diffusion of High Yielding Varieties also affected the tenant farmers adversely. In general, the tenant farmers have a low tendency to adopt the new innovations in their cropping patterns as they are not very sure for how long the land will be available to them for cultivation. The difficulties of tenant farmers have multiplied by the astronomical rise in the value of land in recent decades. The tenants want to lease more land while land owners are reorganising the gains to be achieved by direct management of their fields. Under these circumstances, the landlords are reluctant to get into a position where their tenants might be given title of the land. Numerous evasive tactics have been adopted by the landlords. Some of them have directly evicted their tenants from establishing security of tenure by shifting them frequently. In the absence of more effective land reforms, the prospect is for large number of tenant farmers to join the rank of landless labourers. Compelled by financial constraints, they migrate to big cities in search of employment and to start a new career.

Landless Labourers

One of the assumptions of the High Yielding Varieties that they will generate more employment could also not be achieved. Undoubtedly, the wages of the unorganised agricultural workers have risen by about 20 times. In the areas where Green Revolution is a success, the labourers are finding employment throughout the year, while in many areas the rural employment has declined. The main cause of decline in labour employment is the natural growth of labour and mainly because of the mechanisation of agriculture by the big farmers which displaces labour.

The impact of Green Revolution has been shown in **Table 9.14.** It may be observed from this Table that the large farmers who have better risk taking capacity adopted High Yielding Varieties quickly. They installed tube-wells and pumping sets in their fields and purchased tractors, threshers and harvesters, etc. from the loans they got from the funding agencies and co-operative societies. Consequently, their production and productivity went up substantially. Better income helped them in improving their food and nutrition. Improvements also occurred in their housing. Realising the importance of education, many of them sent their children to the English medium schools of the neighbouring towns and cities. The economic prosperity also made them increasingly conscious about health and sanitation. It was at this stage that some of the big farmers started desiring small families. These steps led to a decline in the fertility rate of big farmers which ultimately reduced their dependency ratio.

Moreover, the economic prosperity and interaction with the well-off urban people inspired them to construct elegant and spacious *pucca* houses. They started consuming more comfort and luxury goods, which in a sense, brought consumerism in the rural society of the regions of successful green revolution.

The traditional farmer became economic farmer who stated thinking all the time in terms of optimising their profit. Being too busy and conscious of the value of his time, he started ignoring the interest of the neighbours and small farmers. On the other hand, he started purchasing the agricultural land of the small and marginal farmers. This broke the well establish reciprocal aid

Some of the important achievements of the White Revolution are as under:

1. The White Revolution made a sound impact on rural masses and encouraged them to take up dairying as a subsidiary occupation.
2. India has become the leading producer of the world. The milk production that was about 17 million tonnes in 1950–51 rose to over 95 million tonnes in 2006–07. The production of milk has gone up by more than six times when compared with that of the Pre-Independence situation.
3. The per capita availability of milk per day at present is about 200 gm as against 100 grams before the White Revolution.
4. The import of milk and milk production has been reduced substantially.
5. The small and marginal farmers and the landless labourers have been especially benefited from the White Revolution.
6. To ensure the success of Operation Flood Programme, research centres have been set up at Anand, Mehsana, and Palanpur (Banaskantha). Moreover, three regional centres are functioning at Siliguri, Jalandhar, and Erode. Presently, there are metro dairies in 10 metropolitan cities of the country, beside 40 plants with capacity to handle more than one lakh litres of milk.
7. Livestock Insurance Scheme was approved in February 2006 and in 2006–07 on a pilot basis in 100 selected districts across the country. The scheme aims at protecting the farmers against losses due to untimely death of animals.

The All India Summary Reports of the 17th Livestock Census released in July 2006 points out that India possesses the largest livestock population in the world after Brazil. It accounts for about 56 per cent of the cattle population of the world's buffalo population and 14 per cent of the cattle population. It ranks first in respect of buffalo and second in respect of cattle population, second in goat population and third in respect of sheep in the world.

Problems and Prospects

Some of the important problems of the White Revolution are as under:

1. Collection of milk from the remote areas is expensive, time consuming, and not viable economically.
2. In most of the villages the cattle are kept under unhygienic conditions.
3. There are inadequate marketing facilities. The marketing infrastructure needs much improvement.
4. The breeds of cattle is generally inferior.
5. The extension service programme is not effective.

In India, dairy development has a great future. It should take the advantage of liberalisation in the global trade and should try to capture international market. Many corporate sector firms like Indana (plants at Nagpur, Hyderabad, and Bangalore), The Sheel International and Milk and Food, and the Amrut Industries are taking advantage of the existing situation of liberalisation and globalisation. The government has constituted Technology Mission for dairy development and Amul Model Co-operatives are being promoted to cover about 60 per cent of the total area of the country.

Growth and Development of Aquaculture

Aquaculture has been used in China since circa 2500 BC. The practice of aquaculture gained prevalence in Europe during theMiddle Ages since fish were scarce and thus expensive.Americans were rarely involved in aquaculture until the late 20th century but California residents harvested wild kelp and made legal efforts to manage the supply starting circa 1900, later even producing it as a wartime resource.In contrast to agriculture, the rise of aquaculture is a contemporary phenomenon.

Types of Aquaculture

1. Algaculture

Algaculture is a form of aquaculture involving the farming of species of algae.The majority of algae that are intentionally cultivated fall into the category of microalgae, also referred to as phytoplankton, microphytes, or planktonic algae.

Macroalgae, commonly known as seaweed, also have many commercial and industrial uses, but due to their size and the specific requirements of the environment in which they need to grow, they do not lend themselves as readily to cultivation on a large scale as microalgae and are most often harvested wild from the ocean.

2. Fish Farming

Fish farming is the principal form of aquaculture, while other methods may fall under mariculture. It involves raising fish commercially in tanks or enclosures, usually for food. Fish species raised by fish farms include salmon, catfish, tilapia, cod, carp, trout, and others.

Increasing demands on wild fisheries by commercial fishing operations have caused widespread overfishing. Fish farming offers an alternative solution to the increasing market demand for fish and fish protein.

3. Freshwater Prawn Farming

A freshwater prawn farm is an aquaculture business designed to raise and produce freshwater prawn or shrimp for human consumption. Freshwater prawn farming shares many characteristics with, and many of the same problems as, marine shrimp farming. Unique problems are introduced by the development life cycle of the main species (the giant river prawn, *Macrobrachium rosenbergii*).

4. Integrated Multi-Trophic Aquaculture

Integrated Multi-Trophic Aquaculture (IMTA) is a practice in which the by- products (wastes) from one species are recycled to become inputs (fertilisers, food) for another. Fed aquaculture (e.g. fish, shrimp) is combined with inorganic extractive (e.g. seaweed) and organic extractive (e.g. shellfish) aquaculture to create balanced systems for environmental sustainability (biomitigation), economic stability (product diversification and risk reduction), and social acceptability (better management practices).

5. Mariculture

Mariculture is a specialised branch of aquaculture involving the cultivation of marine organisms for food and other products in the open ocean, an enclosed section of the ocean, or in tanks, ponds or raceways which are filled with seawater. An example of the latter is the farming of

While India's share of world trade in the poultry and poultry production continues to be very small in the last decade the value of such exports has increased from 11 crore in 1990–91 to Rs. 326 crore in 2005–06. Exports of products such as live poultry, eggs, hatching eggs, frozen eggs, egg powder, and poultry meat to countries including Bangladesh, Sri Lanka, South West Asia, Japan, Denmark, Poland, USA, and Angola augurs well for industry. The value of output from poultry sector is nearly Rs. 20,000 crore.

In India, there are over 250 million hens in the country which laid down about 30 billion eggs during 2005–06. The largest number of poultry population is in Andhra Pradesh followed by Bihar, West Bengal, Tamil Nadu, Maharashtra, Assam, Karnataka, Kerala, Orissa, Madhya Pradesh, Uttar Pradesh, Punjab, and Haryana. Most of the important poultry farms are being developed around almost all the important urban centres like Mumbai, Kolkata, Delhi, Chennai, Hyderabad, Pune, Nagpur, Shimla, Bhubaneshwar, Ajmer, Chandigarh, and Bhopal.

Uninterrupted supplies of feed as well as *avian influenza* are critical for the continued robust growth of the poultry sector.

The Central Poultry Development Organisation has been playing a pivotal role in the implementation of the policies of the Government with respect to poultry as a tool for alleviating nutritional hunger and palliating the impecuniosities of the resource-poor farmers, especially the women. The mandate of the Central Poultrey Development Organisation has been specifically revised, by restructuring all poultry units of this Department to focus on improved indigenous birds, which lay on an average 180–200 eggs per annum and have a vastly improved FCR ratio in terms of feed consumption and weight gain. The Central Poultry Development Organisations have been entrusted with the responsibility of producing excellent germplasm in the form of day-old chicks and hatching eggs of these varieties like Nierbheek, Hitkari, Vanaraja, Shyama, Cari, Chabro, etc. Besides, these organisations are also playing a crucial role in analysing feed samples.

These Organisations, besides conducting the activities stated above, also work for scaling-up of diversification of other avian species like Ducks/Turkeys/Guinea fowl/Japanese Quail, and upgrading of Training Unit into International Tropical Avian Management Institutes in which private-public partnership is envisaged. Presently these Organisations are also supporting and hand-holding the Centrally-sponsored Schemes related to assistance to state poultry farms.

A new Centrally-sponsored scheme called Assistance to State Poultry, is being implemented during the Tenth Plan where one time assistance is provided to suitably strengthen the farms in terms of hatching, brooding, and rearing of birds with provision for feed mill and their quality monitoring and in-house disease diagnostic facilities.

A new scheme, Dairy/Poultry Venture Capital Fund, has been launched during the 2004–05, wherein there is a provision to grant subsidy on interest payment. The nodal agency for the implementation of this scheme is NABARD through nationalised commercial bank. In 2005–06, a total of 49 poultry units involving 2.17 crore was approved.

HORTICULTURE

India is bestowed with varied agro-climates, which is highly favourable for growing large number of horticultural crops such as fruits, vegetables, root tuber, ornamental, aromatic plants, medicinal species and plantation crops like coconut, arecanut, cashew and cocoa. Presently, horticulture crops occupy about 10 per cent of the gross cropped area of the country, producing about

DRY FARMING

The spread of the dry farming is in the regions where the average annual rainfall is less than 75 cm. In these areas the rainfall is scanty and uncertain, where hot and dry conditions prevail. It is not only that the average annual rainfall is low, the variability of rainfall in these areas varies between 25 to 60 per cent. Agriculture in the dry farming regions belongs to fragile, high risking and low productive agricultural ecosystem. The areas in which more than 75 cm of average annual rainfall is recorded are known as the areas of rain-fed agriculture (**Fig. 9.23**).

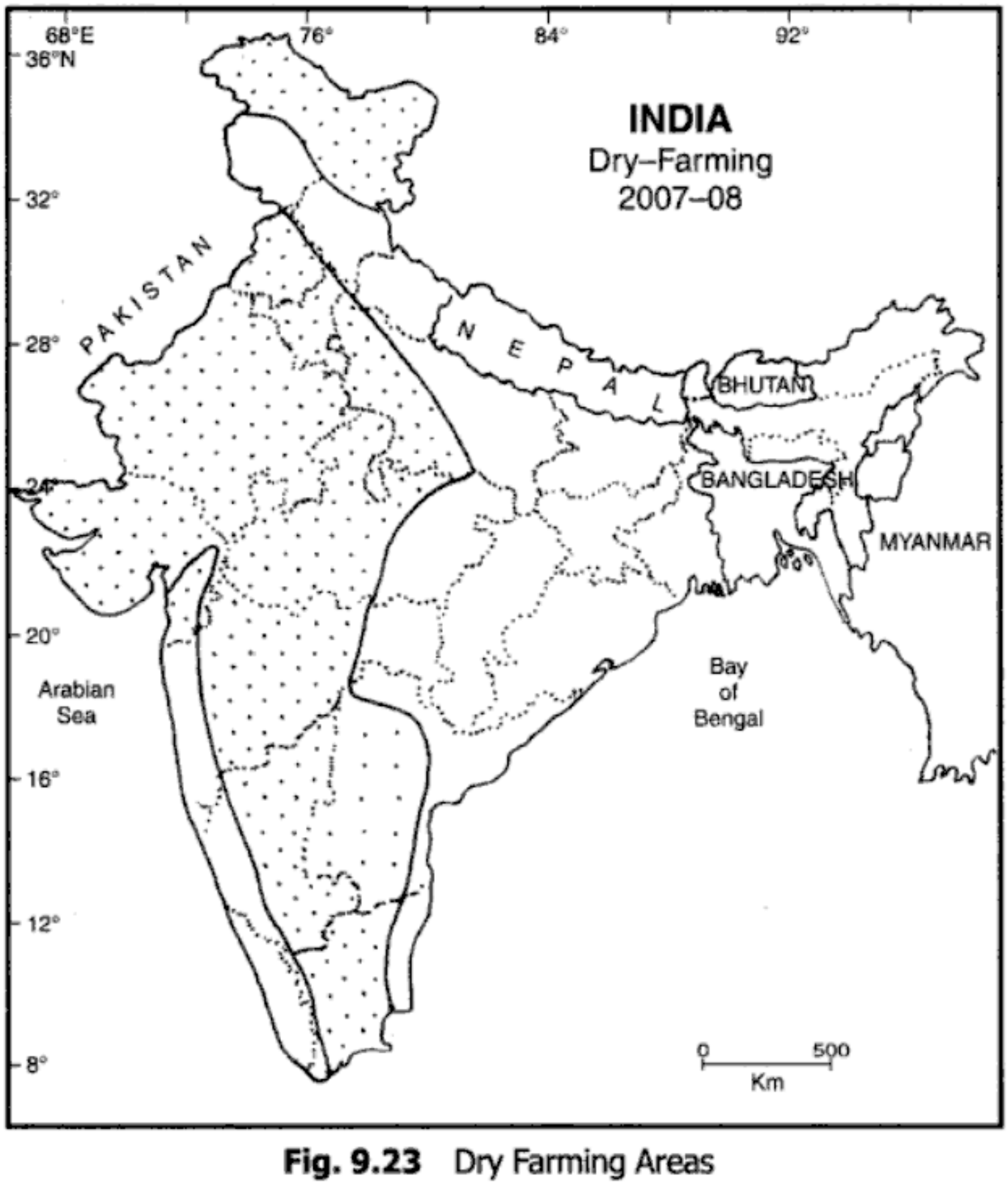

Fig. 9.23 Dry Farming Areas

In India dry-lands cover about 32 million hectares or about 25 per cent of the total arable land. The dry farming areas cover the greater parts of Rajasthan and Gujarat. Moreover, there are small tracts of dry land farming in Punjab, Haryana, Maharashtra, Andhra Pradesh, Karnataka, and Tamil Nadu. These areas having scanty rainfall and high variability of rainfall are adversely affected by erratic precipitation, frequent droughts, high temperature, and high wind velocity resulting in soil erosion.

Griffin, Keith B., 1974, ***The Political Economy of Agrarian Change–An Essay on the Green Revolution,*** Harvard University Press.
Johnston, R.J., 1985, ***A Dictionary of Human Geography,*** Basil and Blackwell.
Khusro, A.M., 1973, ***The Economics of Land Reforms and Farms Size in India,*** Madras, Macmillan.
Husain, M., 2007, ***Systematic Agricultural Geography,*** Jaipur, Rawat Publications.
Poheketr, G.S., 1970, ***Studies in Green Revolution,*** United Asia Publication.
Sen, B. 1974, ***The Green Revolution in India : A Perspective***, New Delhi, Wiley Eastern.
Shafi, M., 2006, **Agricultural Geography**, Delhi, Pearson & Education.
Singh, J., 1974, 1984, ***Agricultural Geography,*** New Delhi, Tata McGraw-Hill Pub.
Symons, L., 1968, ***Agricultural Geography***, London.
The New Encyclopedia Britannica, Vol.I, London, pp. 153–154.
Tiwari, R.C., 2003, ***Geography of India***, Allahabad, Prayag Pustak Bhavan.