Assigned by Ministry of Agriculture, Forestry and Fisheries

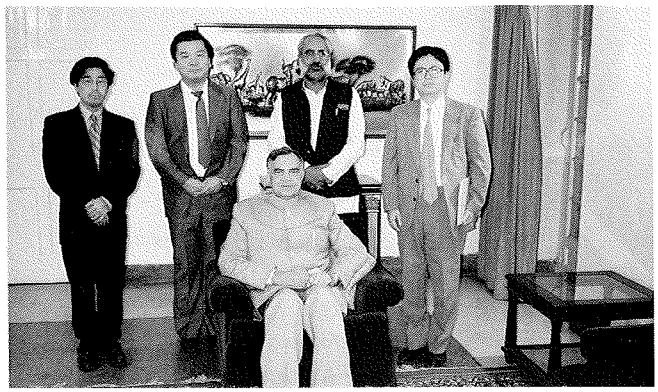
# Report on the Basic Survey on Agricultural and Rural Development by Progress Stage in Asian Countries

## India

(Foucus on Punjab, Haryana, Bihar)

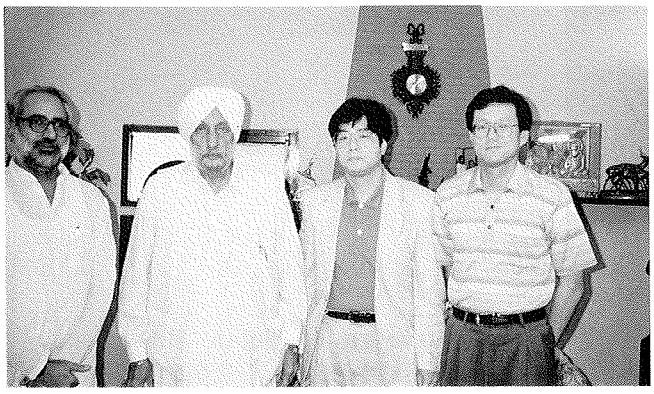
MARCH 1995

The Asian Population and Development Association



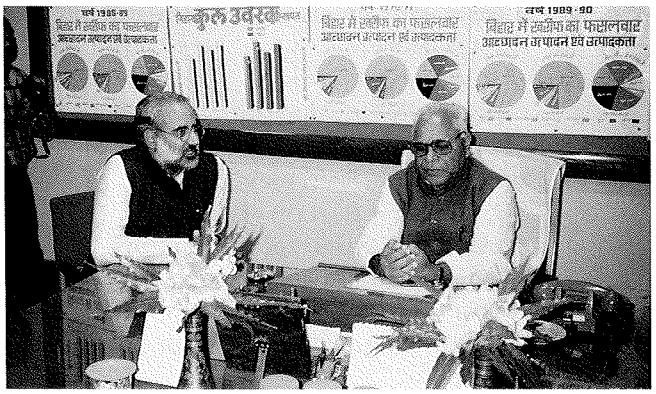
◀Courtesy call on Union Minister of Agriculture.
from right
Seiichi Fukui, Survey team leader
Manmohan Sharma,
Executive Secretary, IAPPD
H. E. Mr. Barlam Jakhar,
Union Minister of Agriculture
Tomomi Otuka, Survey team member
Hisato Shuto, Survey team member

◀Courtesy call Embassy of Japan
from right
Akihiko Ohno,
Preliminary survey team leader
Chusei Yamada, Ambassador
Masato Fukushima, First secretary

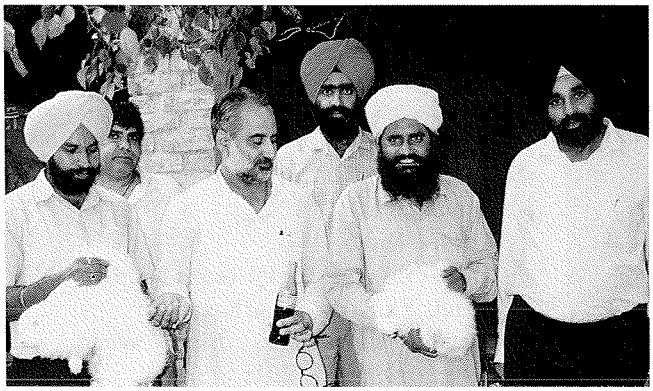


◀Courtesy call on Chief Minister of Punjab
from left
Manmohan Sharma
H. E. Sardar Beant Singh,
Chief Minister of Punjab
Osamu Kusumoto,
Preliminary survey team member
Akihiko Ohno,
Preliminary survey team leader

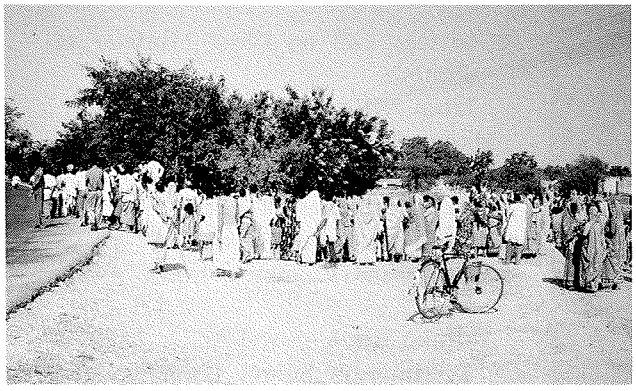
◀Courtesy call on Chief Minister of Haryana
first from right
H. E. Bhajan Lall,
Chief Minister of Haryana



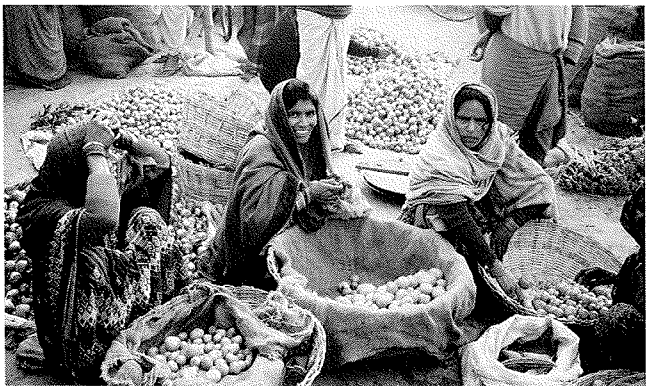
◀Courtesy call on Minister of Agriculture, Bihar
first from right
Hon. Mr. Ramjiwan Singh,
Minister of Agriculture, Bihar



◀Visit to farmer's house at Punjub state
Breeding of Angora rabbit



◀Field survey of South Bihar at Gaya District



◀Vegetable Market at Pusa, North Bihar

# Foreword

This report presents the results of the "Basic Survey on Agricultural and Rural Development by Progress Stage in Asian Countries," consigned by the Ministry of Agriculture, Forestry and Fisheries in 1994, and entrusted to be implemented by the Asian Population and Development Association (APDA) for India. The survey and compilation of the results were carried out mainly by members of APDA's survey committee (Chairperson: Dr. Shigeto Kawano, Professor Emeritus, the University of Tokyo).

The survey was conducted to pursue the following objective: "In extending assistance in terms of agricultural and rural development to Asian countries, it is necessary to consider structural changes in the population and employment of agriculture and rural regions, to clarify the fields of agricultural and rural developmental assistance, the forms of assistance and the regions to receive assistance according to the stage of development and in keeping with the country's policy issues for the comprehensive promotion and improvement of rural areas, and to offer effective and efficient assistance accordingly.

"For this goal, a survey will be conducted in a model district selected from among Asian nations to study the forms of agricultural and rural development according to structural changes in the population and employment, thereby contributing to policy dialogue regarding agricultural and rural development."

The field survey in India was conducted with the guidance and cooperation of Mr. Manmohan Sharma, Executive Secretary, Indian Association of Parliamentarians on Population and Development, as well as Ambassador Chusei Yamada, Mr. Takamichi Okabe, Councellor, and Mr. Masato Fukushima, First Secretary of the Japanese Embassy in India.

In Japan, members of the International Cooperation Division, Economic Affairs Bureau, the Ministry of Agriculture, Forestry and Fisheries, and Aid Policy Divisions, Economic Cooperation Bureau, the Ministry of Foreign Affairs, cooperated in the guidance of the survey substance and arrangement of the field survey. I would like to extend my deepest gratitude to these people.

I sincerely hope that this report will contribute to the advancement of the rural community and agricultural development programs in India, as well as support the Japanese government's cooperation there in an effective manner.

Furthermore, I would like to note that this report was compiled by and is the sole responsibility of the APDA, and does not necessarily reflect any views or policies of the Ministry of Agriculture, Forestry and Fisheries or the Japanese government.

March, 1995

Fukusaburo Maeda

Chairman

The Asian Population and Development Association

# Contents

# Chapter One

## Overview of Agriculture and Rural Economy in India

With the seventh largest land area in the world and the second largest population, India is one of the world's major countries. The developments which have taken place in the various spheres of the economy through the planned process over the roughly 50 years since Independence have taken the country's economic status to a higher level. Agriculture, the primary sector of the economy, constitutes the backbone of its strength and provides employment and income to about two-thirds of the work force. The performance of the agriculture sector for meeting the ever-growing demand, especially in the area of food grain production, has seen revolutionary changes. The introduction of high-yielding variety seeds assisted by the use of such modern inputs as fertilizers, new concepts of irrigation and water management, along with agricultural research from the late 1960s, has enabled the country to attain a greater level of self-sufficiency in this area. Even though the country has achieved a greater level of resilience in the field of agriculture, especially in food grain production, there are various problems which hinder further growth with uniform development of all the regions of the country, as will be seen in the field survey discussed in the following chapter. With rural areas of the country accounting for nearly three-fourths of the population and having a much higher concentration of people below the poverty line, issues such as rural poverty, population pressure, the problem of unemployment and underemployment and pressure on the land due to

population increase and the inevitable smaller size of holdings and their fragmentation have great implications on the agriculture sector, being the primary source of livelihood for the majority of the rural population.

# 1 Overview of Agricultural Development

## (1) Structural changes in the agriculture sector

Nearly three-fourths of the population of India lives in rural areas. The share of the rural population has come down from 82.7% in 1951 to 74.3% in 1991. While the total population of the country has increased from 361.1 million in 1951 to 846.3 million in 1991, the pace of increase in the rural population is slightly higher, from 298.6 million to 628.7 million during this period. In the field of employment, also, agriculture plays a crucial role. The share of cultivators and agricultural labourers in the total work force in the country was 69.4% in 1951. It has only marginally come down to 64.8% in 1991.

The gross cropped area of the country has increased from 131.9 million hectares in 1950-51 to 185.5 million hectares by 1990-91. With the adoption of modern technology, cropping intensity has also increased from 111.1 to 130.4 during this period. As the provision of assured irrigation facilities is a sure guarantee for increasing crop production and productivity, substantial improvements have been made in this sphere also. The gross irrigated area in the country has increased from 22.6 million hectares in 1950-51 to 61.8 million hectares by 1990-91. Among the different crops, however, the share of irrigated area differs greatly. For wheat, it has increased to 79.8% by 1990-91. For rice and barley, it was only 45.1% and 50%, respectively. By 1990-91, 84.2% of the area under sugarcane crop had irrigation facilities. Only in the case of pulses (10%), other coarse grains, oilseeds, etc., the share of the irrigated area is very low.

The share of the agriculture sector alone in the gross domestic product was 48.7% in 1950-51. This share came down to 39.7% in 1970-71, and by 1992-93 has further reduced to 28.1%. With the rapid expansion of the performance of the service sector and the widening of the industrial base, the contribution from these sectors has naturally increased substantially in the recent period.

Though the share of the agriculture sector in the gross domestic product has been decreasing, this sector's share in total employment is still very high at about 65%, as already mentioned. Thus, the structural transition of the national economy is far slower in the employment area than in production. It goes without saying that this generates a major gap in productivity and income between the agricultural and non-agriculture sectors.

## (2) Performance of the agriculture sector

The performance of the agriculture sector since independence has been quite impressive. Its success can be attributed to the application of a modern inputs, services, credit, institutional support and price policies. Table 1 shows the progress made in the agriculture sector over this period. The production of rice has shot up from a level of a mere 20.6 million tonnes in 1950-51 to 79 tonnes in 1993-94, thus exhibiting a rise of 3.8 times. Food grain production is estimated at 182 tonnes in 1993-94, and a production target of 189 million tonnes has been fixed for 1994-95. Between 1950-51 and 1993-94, in the case of wheat there has been a near revolution and the output has increased by 8.9 times. This has led to an improvement in the per capita availability of food grains. Oilseeds (4.2 times), sugarcane (4.1 times), cotton (3.7 times) and jute and mesta (2.6 times) have also witnessed significant increases. There have also been striking increases in the output of potatoes, eggs, fish, fruits and vegetables.

In increasing the production of food grains by more than 3 times (i.e. from 51 million tonnes in 1950-51 to 180 million tonnes in 1992-93), India has passed through three well-identified phases of growth:

a) The first phase from 1949-50 to 1964-65 was marked by the use of traditional technology based on available varieties of seeds and expansion of the area under crops. During this period food grain production increased at the rate of 3.1% per annum. Area expansion and increase in productivity more or less equally contributed to the growth in production.

b) The second phase (i.e. from 1967-68 to 1980-81), after the adoption of a New Strategy, was marked by considerable advances in the process of the modernization of agriculture. As a result, food grain production grew at an annual compound rate of 2.2% during this period. This growth rate is lower than that achieved in the first phase. What is important, however, is that having reached the outer limits of extending arable area, the production increase was realised largely through the increase in yield levels induced by improved coverage of irrigated area and the utilisation of hybrid seeds and fertilizers.

c) The third phase, which began in the 1980s, has been marked by greater emphasis on marketing and trade and the institutional framework which help minimise the handicaps of small and marginal farmers. Despite the setback dealt by successive spells of bad monsoon, the production of food grains increased at a compound rate of 3.4% per annum during this period (1980-81 to 1992-93).

Table 2 shows the growth of food grain production during different periods. We can see that the growth rate of food grain production in India during the longer time frame of 1949-50 to 1992-93 was 2.62%. The rate of growth in the productivity of food grain crops during this period was 1.57% per year, whereas the growth of productivity during the more recent period of 1980-81 to 1992-93 was much higher at 2.84%.

## 2 Agricultural Development Policies

With the country's population expected to reach 941 million by 1997, the terminal year of the ongoing 8th Five-year Plan, the estimated food grain requirement by that time will be around 208 million tonnes. The required development in agriculture can in the long run be achieved only through a regionally more broad-based pattern of growth devoting greater attention and resources to the development of rain-fed tracts efficiently utilising the created irrigation facilities and maintaining a continuous flow of economically viable improved techniques both for rain-fed as well as irrigated areas. The 8th Five-year Plan has addressed itself to meet these challenges. Being the primary sector, the strategy for agricultural development in the 8th Plan aims at not only achieving self-sufficiency in food but also generating surpluses of specific agricultural commodities for export so as to increase the income levels of farmers. The thrust of the agricultural programmes during the 8th Plan is on:

(i) Diversification of agriculture and development of horticulture, livestock, fisheries, etc.;
(ii) Accelerated growth in the northeastern region through improvement in productivity levels;
(iii) Development of rain-fed areas;
(iv) Increased production of oilseeds and pulses;
(v) Revitalisation of cooperatives, agricultural credit structure and improving marketing of agricultural produce; and
(vi) Development of post-harvest technology.

Table 3 shows details regarding plan outlay and expenditures incurred during various plans for agriculture and allied sectors.

From this table, we can clearly see that in the recent period the government has taken various policy measures to further improve the performance of the agriculture sector. Apart from the three-fold increase in the Central Sector Plan Outlay during the 8th Plan period, the government has announced substantially high support prices during the last two years for both kharif and rabi crops. In addition, the process of economic reforms and the liberalisation measures undertaken since mid-1991 are also expected to indirectly help the agriculture sector. As part of economic reforms, the overvalued exchange rate has been corrected. Indian industry, which was earlier enjoying high levels of protection, has been largely deregulated, excepting for some crucial sectors. Such a strategy of reducing the high levels of protection to Indian industry and integrating the national economy with the world economy through trade liberalisation measures are expected to help Indian agriculture. These measures are expected to promote competition, upgrade technology, and reduce costs and prices of industrial goods consumed by farmers. The government has established the Small Farmers' Agri-Business Consortium in order to support innovative ideas for generating income and employment in the

rural areas through the development of agri-business. Various other measures, such as the introduction of a new seed policy which enabled farmers to import high-yielding varieties of seeds and the introduction of a national policy on cooperatives to bring in self-reliant grassroot democratic institutions have also been initiated by the government.

In order to focus on the various problems faced by the agriculture sector and to initiate major action for creating a favourable economic environment for farmers' own efforts and investments to step up agricultural growth, the government has drafted an Agriculture Policy Resolution (APR). Some of the APR's major objectives are to augment facilities for processing, linking and storage, to develop rain-fed irrigated horticulture, to augment bio-mass production, and to increase utilisation of the irrigation potential and promote water conservation.

**Issues Concerning the Agriculture sector**

Though a wide range of policy initiatives have been taken to bring about an all-round development of agriculture, the following issues are particularly important in a development strategy:

① **Increasing production in rain-fed areas**

The benefits of the Green Revolution have had an impact mainly on wheat and rice crops. Other crops such as coarse cereals, oilseeds, etc., which are predominantly grown under rain-fed conditions have not benefited much from its impact. There is a need to evolve varieties suitable for diversified agro-climatic regions of the country and for the benefit of these other crops.

② **Tapping the unexploited potential of Eastern India**

Linked to the above issue, only certain regions such as Punjab, Haryana, parts of Uttar Pradesh, Andhra Pradesh and Tamil Nadu have benefited from the Green Revolution. The bulk of the remaining areas including the eastern region which has great potentials in the form of land and water resources must be brought under its impact.

③ **Raising capital formation in agriculture**

Of all the issues concerning agriculture, the most important one is the sluggish growth in capital formation in this primary sector. The rate of investment in agriculture is stagnating and has even declined in recent years. Gross investment in real terms (at 1980-81 prices) in agriculture has declined from Rs. 46.36 billion in 1980-81 to Rs. 45.67 billion in 1992-93 (estimates). The share of capital formation of agriculture among total gross domestic capital

formation has declined sharply from 18% in 1980-81 to 8.6% in 1992-93. The decline in capital formation in agriculture by the public sector is more perceptible, as it has come down to Rs. 10.25 billion in 1991-92 compared to Rs. 17.96 billion in 1980-81. Since public sector investment acts as a catalyst for spurring private investment, there is a need to step up public sector investment. Details regarding gross capital formation in agriculture since 1970-71 are given in Table 4.

**④ Improving terms of trade for agriculture**

With the favourable price policy measures announced by the government in the recent two years, there has been some improvement in terms of trade in favour of agriculture. However, the overall position has not improved much. There is further need to create the environment to make agriculture a profitable occupation. The fluctuations witnessed in terms of trade since 1970-71 are shown in Table 5.

**⑤ Diversification of farm activities**

Horticultural crops have greater employment potential and also huge prospects in the export sector. Even though India is one of the major producers of horticulture crops, a sizable portion of horticultural products gets destroyed due to the non-application of post-harvest measures. There is a need to concentrate on this area. There is also tremendous scope to expand the activities in dairying, poultry, piggery, aquaculture, sericulture, bee-keeping, etc.

**⑥ Raising agricultural exports**

With the liberalisation of the Indian economy and particularly during the post GATT period, Indian agriculture has to play a greater role on the export front. With negligible import content, the country has a comparative advantage in the cultivation of a number of crops. This needs to be fully exploited. Already under the influence of various measures, such as major liberalisation measures taken under the trade policy, the export of agricultural commodities has shown an increase of 37% in 1993-94 over the performance recorded during the previous year, compared to overall export growth of only 29.5%.

**⑦ Creating additional employment**

Based on Planning Commission data, the number of persons looking for full-time employment in April, 1992 was 23 million. The net additions to the labour force during the periods 1992-97 and 1997-2002 are projected to be 35 million and 36 million respectively. Achieving of the goal of near full employment by 2002 would imply that about 24 million additional employment opportunities would need to be created over the next 10 years. In other words, average employment growth over the next 10 years would have to be 2.6% to

2.8% per annum, compared to the rate of growth of 1.8% per annum realised during the period 1983 to 1987-88. There are great expectations for creating new employment opportunities in agriculture and allied sectors. Agriculture can grow by around 4% with high value crops, animal husbandry by 5 to 6% and fisheries as fast as 7% per annum. Such growth rates would greatly promote the creation of employment opportunities. In addition, since overall human development only ensures all-round progress, the ongoing 8th Five-year Plan has stressed the development of health, education, literacy and basic needs including drinking water, housing and welfare programmes for the weaker sections. The 8th Plan has been formulated so as to focus largely on the objective of creating a social security net through employment generation, improving health care and providing extensive educational facilities throughout the country.

## 3 Issues Concerning Rural Development

Nearly three-fourths of the country's population lives in rural areas. With the much larger concentration of people below the poverty line in these areas, rural development, which encompasses the entire gamut of improvements in the overall quality of life in rural areas, becomes the primary objective for achieving overall economic growth in the country. With all-pervasive poverty being the main hindrance for improving overall rural progress, the thrust of rural development programmes has been to make a frontal attack on poverty through special employment generation programmes, production asset transfer through institutional credit and subsidy programmes, area development programmes, land reforms and programmes of rural housing, drinking water and sanitation. Even though issues like low literacy levels in rural areas, mounting problems related to rural housing, drinking water and the provision of sanitation facilities prevail extensively in rural areas, in the present paper, only issues which have a direct bearing on agricultural development are taken into account. These are problems relating to population pressure, issues relating to employment, poverty and land reforms.

### (1) Population and family welfare

According to the 1991 population census, out of the country's population of 846.3 million, 74.3% live in rural areas. The annual exponential growth rate works out to 2.14% during the 1981-91 decade, marginally lower than the 2.2% during the 1971-81 period. Even though the growth rate achieved in food grain production between 1979-80 and 1989-90 at 3.68% was much higher than the level of population increase, it is not in the long term interest of the country to continue to have unchecked population explosion. The containment of population growth has been accorded priority in the 8th Plan. The Plan aims at reducing the birth rate

from 30.2‰ in 1990 (provisionally estimated at 29‰ in 1992) to 26‰ by 1997. The target of achieving a Net Reproduction Rate (NRR) of 1 by the turn of the century has been now shifted to the period 2011-2016 as per the 8th Plan. In view of the social and religious issued involved, the policy of intervention must eventually develop into a popular mass movement for containing population growth. This would also require that due attention be paid to increasing female literacy, raising the age of marriage of girls, creating employment opportunities for women and raising their status in society. The performance of family planning programmes varies significantly among the states, with the more populous northern states considerably lagging. While there has been progress in urban areas related to accepting family planning programmes due to the comparatively higher literacy level and awareness among the population, in rural areas where poverty coupled with illiteracy, ignorance and social beliefs still dominate, greater efforts need to be taken both by the central and state governments with the active involvement of voluntary agencies. Details regarding population (state-wise) with rural/urban breakdown based on the 1991 census are given in Table 6.

## (2) Labour and Employment

Employment has been one of the major concerns of development planning and policy in India since independence. According to a survey of the National Sample Survey Organisation, employment has grown at about 2% per annum during the decade of 1977-78 to 1987-88. This growth, which has been about the same as the rate of growth of the labour force, has not been able to absorb the backlog of unemployment of about 10.8 million which existed in 1977-78. Compared to urban areas, the growth rate of employment in rural areas was low. Though all major sectors except agriculture experienced over 3% growth in employment per annum during this period, agriculture registered an annual growth of only 0.92%. There has also been a shift in the sectoral structure of employment away from agriculture. The share of agriculture in employment has declined from 71% in 1977-78 to 64% by 1987-88. The provisional results of the 1991 census also show that the share of agriculture in total employment has declined from 66.5% in 1981 to 64.9% in 1991. The shares of the secondary and tertiary sectors have gone up from 12% to 15% and from 17% to 20% respectively. Recent trends in the incidence of unemployment show that while open unemployment has increased, underemployment has declined. There has thus been a shift from a state of widespread unemployment, the trend being particularly stronger in rural areas.

## (3) Poverty

The primary factor which affects the economic progress of the country, especially in rural areas, is all-pervasive poverty levels prevailing in the countryside. Based on household expenditure data obtained through National Sample Survey Rounds, the poverty line was

defined as the per capita monthly expenditure needed to obtain the consumption basket corresponding to the calorie norms of 2400 per capita per day in rural areas and 2100 per capita per day in urban areas in the base year 1973-74. The poverty line was thus defined as Rs. 49.10 for rural areas and Rs. 56.60 for urban areas. This line was updated for subsequent years using suitable indicators of changes in the cost of living. Table 7 shows the estimates of poverty at the national level for the years 1972-93, 1977-78, 1983-84 and 1987-88.

In 1987-88, 29.9% of the total population was living below the poverty line. The poverty level was much higher in the following states: Orissa (44.7%), Bihar (40.8%), Madhya Pradesh (36.7%), Uttar Pradesh (35.1%), Andhra Pradesh (31.7%), Tamil Nadu (32.8%) and Karnataka (32.1%). In order to tackle this problem, the approach to the 8th Plan also stressed the need for a sharper focus on progress made at giving self-employment and wage employment to the poorer sections of the community. To achieve this objective, various schemes of employment generation are being implemented. The Jawahar Rozgar Yojana is the largest single programme during the 8th Five-year Plan. The primary objective of this programme is to generate additional gainful employment for both unemployed men and women in rural areas. Various other programmes such as the Integrated Rural Development Programme, Training for Rural Youth for Self-employment, Nehru Rozgar Yojana are also being implemented. The Employment Assurance Scheme has been launched in order to focus on vulnerable groups such as the selected backward blocks which were recently included under the Revamped Public Distribution System. This scheme aims at providing 100 days of unskilled manual work to the rural poor who are in need of employment.

## (4) Land reforms

One of the important reasons for the low crop productivity in the country is the very small size of holdings. The average size of operational holdings in the country has declined from 2.3 ha in 1970-71 to 1.69 ha in 1985-86. Many of the bigger states which are poor and face the problem of population pressure have operational holdings which are below the national size average. They are Orissa (1.47 ha), Assam (1.31 ha), Uttar Pradesh and Bihar (0.93 ha), West Bengal (0.92 ha) and Kerala (0.40). Due to population pressure and hereditary distribution of land, there has been an increase of 9.3% in the overall number of operational holdings in the country between 1980-81 and 1985-86. The total area operated has increased by only 0.5%. This has inevitably led to further fragmentation of land. Details regarding the state-wise distribution of the number and area of operational holdings and their average size are given in Tables 9 and 10.

In rural society where land is the most relevant source of living for a large section of the people and the rights on land, however small in area, confer socio-economic status and dignity, the importance of land reforms and land records needs no emphasis. The major objectives of

land reforms include: reordering agrarian relations to achieve an egalitarian social structure; elimination of exploitation in land relations; realising the age-old goal of land to the tiller; enlarging the land-base of the rural poor; and increasing agricultural productivity and production. The major components of the strategy of land reforms have been: the abolition of intermediary tenures; tenancy reforms; ceilings on ownership of agricultural holdings; consolidation of holdings; distribution of government wastelands; modernisation and updating of land records systems; conferment of ownership rights on homeless persons; special measures for protection of lands of scheduled castes and tribes; improving access of land to women; and safeguarding of common property resources. In view of the importance of the implementation of land reforms not only for improving agriculture productivity but also for raising the status of farmers, greater efforts need to be given in this direction. Table 11 gives details regarding land ceiling achievements.

## 4 Conclusion

Since independence, the performance of the agriculture sector, especially in food grain production, has been impressive. The implementation of policies and programmes for more than 25 years which led to the Green Revolution has enabled the country to achieve a greater degree of resilience in this field. However, in the process, there have occurred certain distortions in the growth pattern, such as regional disparities and neglect of rain-fed agriculture and crops. In order to address these problems, the ongoing 8th Plan has emphasised the diversification of agriculture and the development of horticulture, livestock, fisheries, etc. Thrust has also been given on the development of rain-fed areas, concentrating on the northeastern region, and the development of post-harvest technology. Deceleration in investment in this primary sector is the main issue affecting its development.

In the recent period, various measure such as substantial increases in plan outlay, removal of restrictions on interstate movement of agricultural commodities and higher support prices have been initiated to assist farming to be more profitable. The establishment of the Small Farmers' Agri-Business Consortium and higher assistance to specialised schemes such as horticulture and bee-keeping not only enable traditional farming activities to be diversified but also assist in creating more employment opportunities in rural areas. The main objective of the recent Draft Agriculture Policy Resolution (APR) is also to create a favourable economic environment for the growth of agriculture and to induce farmers to intensify their efforts and investments in agriculture through a favourable price and trade regime.

By providing employment and income for about two-thirds of the work force and substantially meeting the raw material needs of the industry and export sectors, the agriculture sector will continue to be the real backbone of Indian economy.

## Table 1 Performance of Agriculture

| | Item | Unit | 1950-51 | 1993-94 | Increase (x) |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| I | Total population | Million | 361.1 | 844.3* | 2.3 |
| | Rural population | Million | 298.6 | 627.1* | 2.1 |
| | % of rural to total | | 82.7 | 74.2* | |
| II | Gross domestic product | 10 million rupees | 42871 | 230424 | 5.4 |
| | Gross domestic product for agriculture | 10 million rupees | 23741 | 68745 | 2.9 |
| | % share of agriculture in GNP | | 55.4 | 29.8 | |
| III | Food grain production | Million tonnes | 50.8 | 182 | 3.6 |
| | Rice | Million tonnes | 20.6 | 79 | 3.8 |
| | Wheat | Million tonnes | 6.5 | 57.7 | 8.9 |
| | Total cereals | Million tonnes | 42.4 | 167.8 | 4 |
| | Total pulses | Million tonnes | 8.4 | 14.2 | 1.7 |
| IV | Oilseeds | Million tonnes | 5.2 | 21.7 | 4.2 |
| V | Sugarcane | Million tonnes | 57.1 | 233 | 4.1 |
| VI | Cotton | Million tonnes | 3 | 11 | 3.7 |
| VII | Jute & mesta | Million tonnes | 3.3 | 8.5 | 2.6 |
| VIII | Plantation crops | | | | |
| | Tea | Million tonnes | 0.3 | 0.7* | 2.3 |
| | Coffee | Million tonnes Neg. | | 0.2+ | - |
| | Rubber | Million tonnes Neg. | | 0.4+ | - |
| | Other crops | | | | |
| | Potatoes | Million tonnes | 1.7 | 15.7+ | 9.2 |
| | Onions | Million tonnes | 2.2 | 3.6+ | 1.6 |
| IX | High-yielding varieties of food grains | Million ha. | 15.4 (1970-71) | 66.1+ | 4.3 |
| X | Consumption of fertilizers | 100,000 tonnes | 0.69 | 128.3+ | 185.9 |
| XI | Consumption of pesticides | 1000 tonnes | 2.35 | 75.0+ | 31.9 |
| XII | Livestock products | | | | |
| | Milk | Million tonnes | 17 | 60.8 | 3.6 |
| | Eggs | Billion | 1.8 | 24.4 | 13.6 |
| | Wool | Million kg. | 27.5 | 42.2 | 1.5 |
| XIII | Fish production | 100,000 tonnes | 7.5 | 46.8 | 6.2 |

* : For 1991-92
\+ : For 1992-93

## Table 2 Annual Compound Growth Rates of Food Grains

(Base: triennium ending 1981-82 = 100)

| Period | Area | Production | Productivity |
|---|---|---|---|
| 1. 1949-50 to 1964-65 | 1.58 | 3.15 | 1.21 |
| 2. 1967-68 to 1980-81 | 0.51 | 2.19 | 1.28 |
| 3. 1980-81 to 1993-93 | 0.28 | 3.40 | 2.84 |
| 4. 1949-50 to 1992-93 | 0.68 | 2.62 | 1.57 |

## Table 3 All India Pattern of Outlay and Expenditure in Public Sector

| 5-year plan | Agriculture and allied activities | | | % of agriculture and allied activities | | |
|---|---|---|---|---|---|---|
| | Plan outlay | Actual expenditure | Total outlay | Actual expenditure | Plan outlay | Actual expenditure |
| 1st Plan (1951-56) | 354 | 290 | 2378 | 1960 | 14.9 | 14.8 |
| 2nd Plan (1951-61) | 510 | 549 | 4500 | 4672 | 11.3 | 11.7 |
| 3rd Plan (1961-66) | 1086 | 1089 | 7500 | 8577 | 14.5 | 12.7 |
| Annual Plan (1966-69) | 1037 | 1107 | 6665 | 6625 | 15.6 | 16.7 |
| 4th Plan (1969-74) | 2728 | 2320 | 15902 | 15779 | 17.1 | 14.7 |
| 5th Plan (1974-79) | 4766 | 4865 | 39322 | 69426 | 12.1 | 12.3 |
| Annual Plan (1979-80) | 1815 | 1996 | 12601 | 12176 | 14.4 | 16.1 |
| 6th Plan (1980-85) | 12539 | 15201 | 97500 | 109292 | 12.9 | 13.9 |
| 7th Plan (1985-90) | 22233 | 31509 | 180000 | 218730 | 12.3 | 14.4 |
| Annual Plan (1990-91) | 9142 | 8542 | 64717 | 58369 | 14.1 | 14.6 |
| Annual Plan (1991-92) | 10058 | 9060 | 72317 | 6475 | 13.9 | 14.0 |
| 8th Plan (1992-97) | 63642 | - | 434100 | - | 14.7 | - |
| Annual Plan (1992-93) | 10426 | N.A. | 80772 | N.A. | 12.9 | N.A. |
| Annual Plan (1993-94) | 13002 | N.A. | 100120 | N.A. | 13.0 | N.A. |

N.A. : Not Available
Agriculture and allied activities include animal husbandry, dairy, forestry, plantation, storage, rural development, etc.
Source : Planning Commission

## Table 4 Gross Capital Formation in Agriculture

(10 million rupees)

| Year | Private sector | | Public sector | | Total | |
|---|---|---|---|---|---|---|
| | Current prices | 1980-81 prices | Current prices | 1980-81 prices | Current prices | 1980-81 prices |
| 1970-71 | 825 | 1969 | 329 | 789 | 1154 | 2758 |
| 1971-72 | 930 | 2073 | 382 | 851 | 1312 | 2924 |
| 1972-73 | 1029 | 2131 | 505 | 1049 | 1534 | 3180 |
| 1973-74 | 1230 | 2215 | 567 | 993 | 1797 | 3208 |
| 1974-75 | 1395 | 2056 | 591 | 919 | 1986 | 2975 |
| 1975-76 | 1684 | 2347 | 718 | 1041 | 2402 | 3388 |
| 1976-77 | 2137 | 2880 | 1013 | 1378 | 3150 | 4258 |
| 1977-78 | 1993 | 2539 | 1206 | 1534 | 3199 | 4073 |
| 1978-79 | 2852 | 3549 | 1391 | 1697 | 4243 | 5246 |
| 1979-80 | 3173 | 3443 | 1618 | 1772 | 4791 | 5215 |
| 1980-81 | 2840 | 2840 | 1796 | 1796 | 4636 | 4636 |
| 1981-82 | 3170 | 2720 | 1934 | 1779 | 5104 | 4499 |
| 1982-83 | 3606 | 2850 | 2109 | 1725 | 5715 | 4575 |
| 1983-84 | 3369 | 2390 | 2246 | 1707 | 5615 | 4097 |
| 1984-85 | 4012 | 2878 | 2463 | 1673 | 6475 | 4551 |
| 1985-86 | 4395 | 2806 | 2642 | 1516 | 7037 | 4322 |
| 1986-87 | 4378 | 2587 | 2701 | 1428 | 7039 | 4015 |
| 1987-88 | 5332 | 2957 | 3114 | 1461 | 8446 | 4418 |
| 1988-89 | 5901 | 2985 | 3219 | 1364 | 9120 | 4349 |
| 1989-90 | 7037 | 3198 | 3049 | 1157 | 10086 | 4355 |
| 1990-91 | 8390 | 3440 | 3284 | 1155 | 11674 | 4595 |
| 1991-92 | 9898 | 3556 | 3440 | 1025 | 13338 | 4581 |
| 1992-93 | 10951 | 3535 | 4682 | 1032 | 15633 | 4567 |

Private sector consists of agricultural households and plantation companies in the private corporation sector

## Table 5 Indices of Prices Received and Prices Paid by Farmers and Terms of Trade

(triennium ending 1971-72 = 100)

| Year | Commodities sold for | | | Prices paid for commodities purchased | | | |
|---|---|---|---|---|---|---|---|
| | Final consumption | Intermediate consumption | All commodities | Final consumption | Intermediate consumption | Capital formation | All commodities |
| 1970-71 | 98.8 | 102.9 | 100.5 | 100.6 | 100.3 | 100.5 | 100.0 |
| 1971-72 | 102.7 | 102.1 | 102.5 | 105.7 | 101.6 | 105.1 | 97.5 |
| 1972-73 | 115.3 | 119.2 | 116.9 | 113.2 | 109.6 | 112.9 | 103.5 |
| 1973-74 | 145.0 | 144.9 | 145.0 | 133.6 | 126.3 | 132.3 | 109.6 |
| 1974-75 | 178.0 | 150.2 | 166.8 | 162.3 | 188.1 | 166.9 | 100.0 |
| 1975-76 | 153.4 | 126.2 | 142.4 | 159.4 | 193.1 | 168.3 | 84.6 |
| 1976-77 | 151.8 | 154.7 | 157.0 | 166.0 | 191.5 | 173.2 | 90.6 |
| 1977-78 | 163.9 | 166.1 | 164.8 | 177.3 | 193.6 | 181.6 | 90.7 |
| 1978-79 | 157.2 | 157.0 | 137.1 | 180.7 | 185.1 | 183.9 | 85.4 |
| 1979-80 | 179.0 | 194.9 | 185.4 | 209.5 | 191.0 | 209.3 | 88.6 |
| 1980-81 | 202.2 | 230.6 | 213.6 | 233.3 | 255.0 | 244.8 | 87.3 |
| 1981-82 | 216.6 | 235.4 | 224.2 | 249.1 | 296.4 | 270.5 | 82.9 |
| 1982-83 | 230.8 | 246.7 | 237.2 | 254.5 | 308.2 | 279.9 | 84.7 |
| 1983-84 | 253.0 | 273.2 | 261.1 | 278.4 | 325.6 | 302.6 | 86.3 |
| 1984-85 | 265.3 | 293.0 | 276.8 | 298.1 | 328.8 | 321.8 | 86.0 |
| 1985-86 | 282.4 | 271.5 | 278.0 | 313.2 | 343.3 | 332.4 | 82.4 |
| 1986-87 | 299.8 | 320.2 | 308.0 | 337.3 | 368.6 | 361.2 | 85.3 |
| 1987-88 | 328.7 | 377.0 | 348.2 | 382.7 | 387.5 | 400.5 | 86.9 |
| 1988-89R | 364.3 | 363.6 | 364.0 | 402.5 | 390.5 | 422.2 | 86.2 |
| 1989-90R | 384.3 | 407.2 | 393.5 | 440.2 | 401.4 | 455.1 | 86.5 |
| 1990-91R | 423.4 | 500.9 | 454.6 | 490.6 | 448.0 | 505.1 | 90.0 |
| 1991-92R | 509.3 | 528.2 | 516.9 | 549.9 | 524.4 | 570.1 | 90.7 |
| 1992-93P | 552.6 | 494.3 | 529.1 | 593.9 | 606.4 | 623.0 | 84.9 |
| 1993-94P (April to January) | 602.8 | 533.2 | 576.8 | 622.6 | 672.4 | 658.9 | 87.5 |

R : Revised
P : Provisional

## Table 6 Population by State - 1991 Census

| | Total | Male | Female | Rural | Urban | Scheduled castes | Scheduled tribes |
|---|---|---|---|---|---|---|---|
| India | 846302688 | 439230458 | 407072230 | 628391676 | 217611012 | 138223277 | 67758380 |
| Andhra Pradesh | 66508008 | 33724581 | 32783427 | 48620882 | 17887126 | 10592066 | 4199481 |
| Arunachal Pradesh | 864558 | 465004 | 399554 | 753930 | 110628 | 4052 | 550351 |
| Assam | 22414322 | 11657989 | 10756333 | 19926527 | 2487795 | 1659412 | 2874441 |
| Bihar | 86374465 | 45202091 | 41172374 | 75021453 | 1353012 | 12571700 | 6616914 |
| Goa | 1169793 | 594790 | 575003 | 690041 | 479752 | 24364 | 376 |
| Gujarat | 41309582 | 21355209 | 19954373 | 27063521 | 14246061 | 3060358 | 6161775 |
| Haryana | 1663648 | 8827474 | 7636174 | 12408904 | 4054744 | 3250933 | - |
| Himachal Pradesh | 5170877 | 2617467 | 2553410 | 4721681 | 449196 | 1310296 | 218349 |
| Jammu & Kashmir | 7718700 | 4014100 | 3704600 | 5879300 | 1839400 | N. A. | N. A. |
| Karnataka | 44977201 | 22951917 | 22025284 | 31069413 | 13907788 | 7369279 | 1915691 |
| Kerala | 29098518 | 14288995 | 14809523 | 21418224 | 7680294 | 2886522 | 320967 |
| Madhya Pradesh | 66181170 | 34267293 | 31913877 | 50842333 | 15338837 | 9626679 | 15399034 |
| Maharashtra | 78937187 | 40825618 | 38111569 | 48395601 | 30541586 | 8757842 | 7318281 |
| Manipur | 1837149 | 938359 | 898790 | 1331504 | 505645 | 37105 | 632173 |
| Meghalaya | 1774778 | 917687 | 867091 | 1444731 | 330047 | 9072 | 1517927 |
| Mizoram | 689756 | 358978 | 330778 | 371810 | 317946 | 691 | 653565 |
| Nagaland | 1209546 | 641282 | 568264 | 1001323 | 208223 | - | 1060822 |
| Orissa | 31659736 | 16064146 | 15595590 | 27424853 | 4234983 | 5129314 | 7032214 |
| Punjab | 20281969 | 10778034 | 9503935 | 14288744 | 5993225 | 5742528 | - |
| Rajasthan | 44005990 | 23042780 | 20963210 | 33938877 | 10067113 | 7607820 | 5474881 |
| Sikkim | 406457 | 216427 | 190030 | 369451 | 37006 | 24084 | 90901 |
| Tamil Nadu | 55858946 | 28298975 | 27559971 | 36781354 | 19077592 | 10712266 | 574194 |
| Tripura | 2757205 | 1417930 | 1339275 | 2335484 | 421721 | 451116 | 853345 |
| Uttar Pradesh | 139112287 | 84036957 | 65075330 | 111506372 | 27605915 | 29276455 | 287901 |
| West Bengal | 68077965 | 35510633 | 32567332 | 49370364 | 18707601 | 16080611 | 3808760 |
| (Union Territories) | | | | | | | |
| Andaman & Nicobar Islands | 280661 | 154369 | 126292 | 205706 | 74955 | - | 26770 |
| Chandigarh | 642015 | 358614 | 283401 | 66186 | 575829 | 105977 | - |
| Dadra & Nagar Haveli | 138477 | 70953 | 67524 | 126752 | 11725 | 2730 | 109380 |
| Daman & Diu | 101586 | 51595 | 49991 | 54043 | 47543 | 3891 | 11724 |
| Delhi | 9420644 | 5155512 | 4265132 | 949019 | 8471625 | 1794836 | - |
| Lakshadweep | 54707 | 26618 | 25089 | 22593 | 29114 | - | 48163 |
| Pondicherry | 807785 | 408081 | 399704 | 290800 | 516985 | 131278 | - |

N.A. : Not Available

\- : Nil

Note : The census was not conducted in J&K in 1991. The figures for J&K are projected population figures for the year 1991. The projected figures of scheduled castes and tribes for J&K are hence not available.

Source : Census of India, Series-1, Paper 2 of 1992 - Final Population Totals - Brief Analysis of Primary Census Abstracts

## Table 7 Percentage of Population Living Below the Poverty Line

| Areas | 1972-73 | 1977-78 | 1983-84 | 1987-88 |
|---|---|---|---|---|
| Rural | 54.1 | 51.2 | 40.4 | 33.4 |
| Urban | 41.2 | 38.2 | 28.1 | 20.1 |
| Combined | 51.5 | 48.3 | 37.4 | 29.9 |

Source : Planning Commission

## Table 8 No. of Operational Holdings, Area Operated and Average Size of Holding

| Item | 1970-71 | 1976-77 | 1980-81 | 1985-86 |
|---|---|---|---|---|
| No. of operational holdings (million) | 71.0 | 81.57 | 88.9 | 97.2 |
| | | (14.9) | (8.9) | (9.3) |
| Area operated (million ha) | 162.0 | 163.34 | 163.80 | 164.56 |
| | | (0.8) | (0.3) | (0.5) |
| Average size of holding (ha) | 2.3 | 2.0 | 1.84 | 1.69 |
| | | (-13.0) | (-8.0) | (-8.2) |

Note : Figures in parentheses indicate percentage change between two successive censuses.

## Table 9 Number and Area of Operational Holdings

| | Number | | Percentage change | Area operated | | Percentage change |
|---|---|---|---|---|---|---|
| | 1985-86 | 1980-81 | | 1985-86 | 1980-81 | |
| Uttar Pradesh | 18985 | 17917 | 6.6 | 17648 | | -1.8 |
| | (19.5) | (20.1) | | (10.7) | () | |
| Bihar | 1711 | 11030 | 6.2 | 10898 | | -1.5 |
| | (12.1) | (12.4) | | (6.6) | () | |
| Andhra Pradesh | 8231 | 7370 | 11.7 | 14158 | | -1.3 |
| | (8.5) | (8.3) | | (8.6) | () | |
| Maharashtra | 8101 | 6862 | 18.1 | 1352 | | -0.1 |
| | (8.3) | (7.7) | | (3.0) | () | |
| Tamil Nadu | 7707 | 7191 | 7.2 | 7796 | | 1.1 |
| | (7.9) | (8.1) | | (4.7) | () | |
| Madhya Pradesh | 7603 | 6411 | 18.6 | 2155 | | 1 |
| | (7.8) | (7.2) | | (3.5) | () | |
| West Bengal | 6130 | 5878 | 4.3 | 5643 | | 1.6 |
| | (6.3) | (6.6) | | (3.4) | () | |
| Karnataka | 4919 | 4309 | 14.2 | 11879 | | 1.1 |
| | (5.1) | (4.9) | | (7.2) | () | |
| Rajasthan | 4743 | 4487 | 5.7 | 20589 | | 3.3 |
| | (4.9) | (5.0) | | (12.5) | () | |
| Kerala | 4408 | 4181 | 5.4 | 1767 | | -2.1 |
| | (4.5) | (4.7) | | (1.1) | () | |
| Orissa | 3586 | 3328 | 7.7 | 5261 | | -0.3 |
| | (3.7) | (3.7) | | (3.2) | () | |
| Gujarat | 3145 | 2930 | 7.3 | 9954 | | -1.5 |
| | (3.2) | (3.3) | | (6.1) | () | |
| Assam | 2419 | 2298 | 5.3 | 3161 | | 1.3 |
| | (2.5) | (2.6) | | (1.9) | () | |
| Haryana | 1347 | 1012 | 33.1 | 3714 | | 4.3 |
| | (1.4) | (1.1) | | (2.3) | () | |
| Jammu & Kashmir | 1185 | 1035 | 14.5 | 1025 | | -0.5 |
| | (1.2) | (1.2) | | (0.6) | () | |
| Punjab | 1088 | 1020 | 6.7 | 4104 | | -0.5 |
| | (1.1) | (1.1) | | (2.5) | () | |
| Himachal Pradesh | 753 | 638 | 18.0 | 980 | Nil | |
| | (0.8) | (0.7) | | (0.6) | () | |
| Tripura | 312 | 308 | 1.3 | 318 | | -3.6 |
| | (0.3) | (0.3) | | (0.2) | () | |
| Meghalaya | 171 | 170 | 0.5 | 302 | | 2.0 |
| | (0.2) | (0.2) | | (0.2) | () | |
| Manipur | 140 | 136 | 2.9 | 174 | | 3.0 |
| | (0.2) | (0.2) | | (0.1) | () | |
| Nagaland | 125 | 116 | 7.8 | 933 | | 8.6 |
| | (0.1) | (0.1) | | (0.6) | () | |
| Arunachal Pradesh | 85 | N. A. | - | 344 | - | - |
| | (0.1) | () | | (0.2) | () | |
| Goa | 76 | N. A. | - | 78 | - | - |
| | (0.1) | () | | (Neg.) | () | |
| Mizoram | 52 | N. A. | - | 82 | - | - |
| | (0.1) | () | | (Neg.) | () | |
| Sikkim | 38 | 56 | -32.2 | 102 | | -6.4 |
| | (Neg.) | (0.1) | | (0.1) | () | |
| All Union Territories | 95 | N. A. | - | 146 | - | - |
| | (0.1) | () | | (0.1) | () | |
| All India | 97160 | 88883 | 9.3 | 164562 | | 0.5 |
| | (100.0) | (100.0) | | (100.0) | () | |

Figures in brackets are percentages.

Source : Agricultural Census, 1985-86

## Table 10 State-wise Average Size of Operational Holdings

(ha)

| | 1985-86 | 1980-81 | Percentage change |
|---|---|---|---|
| Nagaland | 7.46 | 7.41 | 0.7 |
| Rajasthan | 4.34 | 4.44 | -2.3 |
| Arunachal Pradesh | 4.05 | - | - |
| Punjab | 3.77 | 3.82 | -1.3 |
| Gujarat | 3.17 | 3.45 | -8.1 |
| Madhya Pradesh | 2.91 | 3.42 | -14.9 |
| Haryana | 2.76 | 3.52 | -21.6 |
| Sikkim | 2.68 | 1.94 | 38.1 |
| Maharashtra | 2.64 | 3.11 | -15.1 |
| Karnataka | 2.41 | 2.73 | -11.7 |
| Meghalaya | 1.77 | 1.74 | 1.7 |
| Andhra Pradesh | 1.72 | 1.94 | -11.3 |
| Mizoram | 1.58 | - | - |
| Orissa | 1.47 | 1.59 | -7.5 |
| Assam | 1.31 | 1.36 | -3.7 |
| Himachal Pradesh | 1.30 | 1.54 | -15.6 |
| Manipur | 1.24 | 1.24 | 0.0 |
| Goa | 1.03 | - | - |
| Tripura | 1.02 | 1.07 | -4.7 |
| Tamil Nadu | 1.01 | 1.07 | -5.6 |
| Bihar | 0.93 | 1.01 | -7.9 |
| Uttar Pradesh | 0.93 | 1.00 | -7.0 |
| West Bengal | 0.92 | 0.95 | -3.2 |
| Jammu & Kashmir | 0.86 | 0.99 | -13.1 |
| Kerala | 0.40 | 0.43 | -7.0 |
| All Union Territories | 1.54 | - | - |
| All India | 1.69 | 1.84 | -8.2 |

Source : Agricultural Census, 1985-86

## Table 11 Land Ceiling Achievements

(in 100,000 acres) (30th Sep. 1993.)

| | Area declared surplus | Area taken possession | Area distributed | Beneficiaries (in 100,000) |
|---|---|---|---|---|
| Andhra Pradesh | 8.01 | 5.72 | 5.11 | 4.37 |
| Assam | 6.10 | 5.65 | 4.90 | 4.27 |
| Bihar | 4.75 | 4.00 | 2.79 | 3.30 |
| Gujarat | 2.48 | 1.56 | 1.30 | 0.30 |
| Haryana | 1.21 | 1.16 | 1.13 | 0.40 |
| Himachal Pradesh | 2.84 | 2.81 | 0.03 | 0.04 |
| Jammu & Kashmir | 4.56 | 4.50 | 4.50 | 4.50 |
| Karnataka | 2.74 | 1.60 | 1.17 | 0.72 |
| Kerala | 1.36 | 0.94 | 0.64 | 1.43 |
| Madhya Pradesh | 2.91 | 2.59 | 1.85 | 0.72 |
| Maharashtra | 7.23 | 6.48 | 5.57 | 1.39 |
| Manipur | 0.02 | 0.02 | 0.02 | 0.02 |
| Orissa | 1.74 | 1.63 | 1.51 | 1.30 |
| Punjab | 1.38 | 1.05 | 1.02 | 0.27 |
| Rajasthan | 6.10 | 5.52 | 4.40 | 0.76 |
| Tamil Nadu | 1.85 | 1.71 | 1.50 | 1.24 |
| Tripura | 0.02 | 0.02 | 0.02 | 0.01 |
| Uttar Pradesh | 5.39 | 5.08 | 3.66 | 3.16 |
| West Bengal | 12.70 | 12.01 | 9.40 | 20.57 |
| D&N Haveli | 0.10 | 0.10 | 0.07 | 0.03 |
| Delhi | 0.01 | 0.00 | 0.00 | 0.00 |
| Pondicherry | 0.02 | 0.01 | 0.01 | 0.01 |
| Total | 73.52 | 64.16 | 50.49 | 48.81 |

Source : Ministry of Rural Development

# Chapter Two

# Report on Field Survey

## 1 Northwestern India - A Granary

Agricultural problems of India are generally taken to be (1) stagnant agriculture with low land productivity due mainly to insufficient agricultural infrastructure such as inadequate irrigation and (2) poverty itself often connected to the India's tangled tenurial and caste systems. It is true that the central issue of Indian agriculture continues to be the food problem. The northwestern region of India as a granary nourishing the country (see Figure 1), however, occupies a special position. This region was formed through the process of the Green Revolution which started in the mid-60s. As will be described in more detail later on, the agricultural trends in this region will significantly affect India's future macroeconomic performances, particularly the ongoing liberalization policy.

The regions of India's granary consists of the states of Punjab, Haryana and the western part of Uttar Pradesh known as doab. For the lack of sufficient data, we will not discuss the doab in this paper, though the agricultural situation there can be assumed to be about the same as in Punjab.

The cropped areas of Punjab in 1989-90 was 5,650,000 hectares, 7,393,000hectares in Haryana. Although the two states only account for 3.52% of the total cropped area of India, in

terms of production they account for 35.4% of wheat and 10.6% of paddy. As the region is originally a wheat-growing zone in which rice is rarely eaten, the rice produced there is mostly supplied to other states. As the two states contribute majority of foodgrains required to meet the needs of the country's public distribution system (see Table 1), the region truly deserves to be called a granary of India. As a result of its progressive agriculture, the per capita income in 1991-92 was 9,769 rupees in Punjab, 8,690 rupees in Haryana, far above the national average of 5,583 rupees, and triple that of 2,904 rupees in the poorest state of Bihar. The two states rank first and second state of Bihar. The two states rank first and second in terms of per capita income despite that there are no large industrial cities like Calcutta or Bombay.

In this chapter we will focus our attention on: (1) the relationship between agriculture in northwestern India and the Indian economy, and (2) factors behind the prosperous agriculture of the region.

## (1) Northwestern India and the Indian Macro-economy

We can say that the notable role of agriculture in northwestern India was to extricate the Indian economy out of the Ricardian growth trap.

It goes without saying that India has massive surplus labor. According to the familiar dual economy model of W. A. Lewis, as long as surplus labor exists, the industrial sector can enjoy unlimited supplies of labor from the agricultural sector at the minimum subsistence wage level. This enables the industrial sector to accumulate capital advantageously for further industrialization. For economies with surplus labor like India, it is imperative to manage economy as indicated by the Lewis model. Historically speaking, however, it was rather a case in which such a growth path is obstructed mainly by the constraint placed by the limited supply of food, due to the stagnant agricultural sector. This argument is known as the Ricardian growth trap. That is to say, in the situation where land frontier has disappeared, it is necessary to ensure a supply of food to the growing population and in particular to the non-agricultural workers in cities through the increase in land productivity. If agriculture is stagnant, insufficient agricultural production may hinder economic growth in the following manner. The shortage of food supply rises the price of food which is characterized as wage goods in the early stages of modern economic growth. This increases the real wage rate and, hence, reduces the profits of the industrial sector. As capital formation is repressed, industrial growth is hindered. This is the state Ricard referred to, and what we will call the Ricardian internal trap in this chapter. Attempting to resolve this problem of food shortages through the import of grains puts pressure on the internal balance of payments, restricting the import of capital goods

and technology essential for industrialization. This also results in a stagnation of industrialization. This is an expression of the Ricardian growth trap in terms of open economy, and what we will Ricardian external trap.

India is experiencing the same rapid population growth as other developing nations of Asia. In addition the proportion of population under the poverty line was 55.2% in 1960-61, 48.4% in 1972-73, 48.3% in 1977-78, 37.1% in 1982-83, and still as high as 29.9% in 1986-87. Taking into these facts into consideration, the Indian economy is till runs the risk of falling into the Ricardian growth trap in the future, even though India needs not rely on food import currently. One of the conditions we can give for the take-off of the Indian economy is that the industrial sector effectively mobilizes the unlimited supply of labor as longer as possible without falling into the Ricardian growth trap.

Now let us examine this issue in more detail, referring to Table 2. The population growth rate which began to before independence and accelerated after independence made food shortages an urgent problem. The consumption of foodgrains including pulses, which was between 500 and 600 grams per capita per day at the beginning of the century, started to decrease gradually and at the time of two successive years of drought in the mid-60s it dropped to almost 400 grams. It must be noted that this level was not achieved by the domestic food production alone but also by foodgrain imports.

Grain assistance based on Public Law 480 (PL480), the exports of US agricultural surplus under the US Agricultural Trade Development and Assistance Act of 1954, increased rapidly beginning in the 1950s. While the imports of PL 480 rice was equal less than 10% of the marketable surplus from domestic production, for wheat it exceeded the domestic marketable surplus in the middle of the 1950s, reaching as high as 236.1% when the sever drought hit India in 1966. Foodgrain imports also began to increase in the second half of the 1950s, and in the great drought of the mid-60s foodgrains accounted for 31.3% of total imports. This demonstrates import of foodgrains played an important role on the recovery of internal food balance.

At the time of severe drought, the foreign currency situation began to deteriorate as can be indicated by the ratio of reserve in foreign currency to imports due to unprecedented amount of foodgrain imports (see Table 2). Because of the deterioration in the foreign currency situation, imports of the machinery required for industrialization came to be restricted. This is truly a manifestation of the Ricardian external trap. After this period and through the 1970s, the Indian economy experienced long-term stagnation. The reason the Indian economy fell into an external trap rather than an internal one is no doubt because with a substantially high proportion of the population below the poverty line, India had to avoid the internal trap of rising foodgrain prices at all costs. Actually even during the periods of food shortages the ratio of food prices to general consumer prices did not rise all that much.

With the food shortages of the 1960s, the Indian government under a severe budget constraint adopted such measures as the Intensive Agricultural Area Programs (1964-65) stressing agricultural investment in areas where the agricultural infrastructure was relatively developed. HYV seeds with an assured water supply and chemical fertilizer constitutes the package, called the new farming method of the Green Revolution. Under the High Yielding Varieties Program (1966) a package of HYV seeds-fertilizer-water were almost exclusively distributed to those areas. As a result India, especially its northwestern region witnessed remarkable increases in foodgrain production and consequently foodgrain imports decreased rapidly (see Table 2).

The following four points need to be made concerning the above. First the fact that the need to import grains disappeared only means that India achieved self-sufficiency for foodgrains, and not that the domestic shortage of food was resolved. This is clear from the fact that the proportion of the population under the poverty line is still high. In addition, the regional disparity of income, typified by the gaps between the granary of northwestern India and the poorest state of Bihar, remains serious problems. This situation is accurately conveyed on Figure 2, which compares the distribution of income measured in terms of per capita expenditure of land owning farmers and landless agricultural workers between the two states of Punjab and Haryana in northwestern region and the poorest state of Bihar. Agricultural workers are among the poorest in the country which constitutes some 30% of the total workforce in the rural areas. One can easily notice the notable income gap by seeing that the distribution of income of agricultural workers in the northwest is about the same that of land owning farmers in Bihar. Therefore the wide regional disparity is an important issue to be tackled with. Second, it is true that it became possible to save foreign currency with the decrease in foodgrain imports. However, the enormous volume of chemical fertilizers, essential inputs for the Green Revolution, have to be imported. This puts pressure on the foreign currency situation (See Table 2). Speaking from Japan's experience before World War II in which the supply of inexpensive chemical fertilizer facilitated the growth of agriculture, it will likely be necessary to increase the domestic production of chemical fertilizers in the future. Considering that expenditures for subsidies to chemical fertilizers are a major cause of in India's financial deficit, and that the reduction of subsidies for chemical fertilizers is said to be one of conditionalities for loan from the IMF, increase in the domestic production of chemical fertilizer at low a major issue. The third is on the changes in agricultural policies after self-sufficiency in foodgrains was achieved. In promoting the Greed Revolution, the Agricultural Price Committee established in 1965 submitted to the government a policy for the prices of agricultural outputs and inputs, calling for subsidies for the procurement price as to major foodgrains and the use of such modern inputs as high yielding varieties of seeds, chemical fertilizers, pesticides and electricity for irrigation. As is shown in Figure 3, this

policy of prioritizing agriculture gave agriculture advantageous terms of trade relative to industry after the middle of the 1960s. This provided incentives to farmers to introduce new farming methods of the Green Revolution. Economic Survey of India, 1977-78, expressed the substantially optimistic forecast that the foodgrains and foreign reserve shortages that had hindered economic growth would no longer be constraints. At this stage, the financial expenditure necessary for the policy of prioritizing agriculture became a heavy burden for the government, and agriculture-related subsidies began to be reduced. As a result, terms of trade between agricultural and industrial sectors took a disadvantageous turn for agriculture. This met with resistance by farmers in northwestern India, particularly in Punjab, and became one cause for the political instability of the Punjab which included the assassination of Prime Minister Indira Gandhi. Finally, considering the continuing growth of the population, we should point out that there is still a substantially high risk of India once again falling into the Ricardian growth trap in promoting industrialization with the current policies of liberalization. In particular, it should be noted that the successes of the Green Revolution were limited to regions in which agricultural infrastructure had been already developed. When India is met with food shortages in the future, she will be forced to extend the Green Revolution in the agriculturally backward areas that require vast initial investments for the establishments of agricultural infrastructure.

## (2) Agricultural Development in northwestern India

### ① Emergence of the granary

The Green Revolution had made the northwestern region as the granary of India. As is well known, the Green Revolution as new farming methods consists of the combination of three elements: high yielding varieties of seeds (HYVs), irrigation and chemical fertilizers. It can be said that in the northwestern region of India the combination of these elements is successfully introduced. By studying the process of the Green Revolution in northwestern India, therefore, we can examine the possibilities for its spread to other regions.

**Cropping pattern**

Water availability and rainfall are the principal factors explaining the agricultural patterns of India. The crops concerned are grouped as kharif (summer) and rabi (winder) crops. Kharif crops, such as rice, bajra, maize and cotton are sown at the beginning of the monsoon in July and harvested October to December. However its sowing time is subject to change since the onset of the monsoon is unstable. Rabi crops are sown in September when moisture from the monsoon rains remains in the soil in un-irrigated areas (barani), or in October or November in

canal-irrigated areas (neheri) and well-irrigated areas (chahi), and harvested in April.

Table 3 compares the proportion of the area under different crops to total cropped area between the pre-HYV period (1960-61) and the post-HYV period (1991-92). This region was originally a wheat zone with rabi as the principal season. With the start of the Green Revolution, however, the cropping pattern changed drastically. The preferred cereal of the Green Revolution are wheat and rice. While the proportion of area under wheat increased from the very nature of things, HYV rice spread rapidly in the kharif season. This created a two-crop zone of rabi rice and kharif wheat in the northwestern region of India. Since rice cultivation requires intensive water management, the diffusion of HYV rice took relatively longer time as compared to HYV wheat (see Figure 5). When the diffusion of HYVs was virtually completed in the 1980s, the growth of land productivity reached plateaus. At this point land productivity of the region had already reached approximately twice the Indian average for both wheat and rice.

**② Factors behind the emergence of the granary**

Most important factors which allowed northwestern India to become a granary are: 1) the well-established irrigation system; and 2) land consolidation.

**Irrigation**

The two-crop zone of wheat and rice consists mainly of the belt extending from Punjab through Karnal district of northeastern Haryana to western Uttar Prasesh. In the central and southwestern region of Haryana, on the other hand, only HYV wheat was introduced and kharif remains a secondary season with some minor crops. This contrast is explained mainly by the Delhi-Shahpur (Pakistan) buried suballuvial ridge which is impermeable (see Figure 6). On the north side ground water is at a depth of 15 to 20 meters. Accordingly, the use of ground water resources is limited on the southern side. Also, the water on the southern side is saline, so excessive use of ground water leads to saline soil. Because of this, the spread of tube-wells considered essential for the introduction of HYV rice is restricted to the north side of ridge. The irrigation ratio currently surpasses 90% in Punjab and 70% in Haryana. The lower ratio in Haryana is due to the fact that in the southern area of the ridge the ratio is only 50%. In the north of the ridge in Haryana it reaches virtually 100%. Irrigation facilities in northwestern India is far above the national average of 33.1% (1989-90).

Table 5 shows the changes in the methods of irrigation. The development of tube-well irrigation deserves special attention. For the introduction of HYV rice which needs intensive water management tube-wells are imperative. In this region, irrigation with the Persian wheels using bullock labor was prevalent. But they were rapidly replaced with tube-wells that have larger tapping ability. In Haryana, where separate figure are available, in 1980-81 the Persian

wheels supplied water for only 1.2% of irrigated area. Today there are virtually no Persian Wheels in operation. Though there is the problem that the shallow tube-wells will have to be replaced with deep tube-wells in the future since the ground water level is dropping about 2 cm per year due to the excessive use, northern India has excellent irrigation conditions in both quality and quantity.

A mean annual rainfall reached a level of 1,000 mm in northern Punjab, but decreases gradually as one heads southwest. A line of 500 mm runs almost along the ridge, behind which extends a semi-arid zone (see figure 6). The soil in the southern part of Haryana is sandy loam with poor water retention. The network of canals constructed in colonial era is concentrated on the north side of the ridge. Because of this, irrigation facilities are better on the north side, which enabled the emergence of a two-crop zone of wheat and rice.

As the differences in the irrigation system is due mainly to different natural conditions, the distinct pattern of agricultural development observed in northwestern India, will likely remain a fixed regional characteristic in the foreseeable future.

The experience of northwestern India, with two distinct patterns of agricultural development based on the different levels of irrigation facilities, can offer implications for agricultural development of other regions of India. In particular, it is worth noting that, the availability of ground water is much favorable in West Bengal and part of Bihar when compared to the southwestern part of Haryana. However tube-well irrigation is not relevant in the agriculturally backward states of West Bengal and Bihar. This contrasting situation can be partly explained how effectively land consolidation was completed.

**Land consolidation**

The Indo-Gangestic plains are endowed with relatively favorable ground water resources for the use of tube-wells. However, the spread of tube-wells is concentrated in the western part of the Indo-Gangestic plains, in Punjab, Haryana and Uttar Pradesh (particularly in the west). One of the shackles to agricultural development in India is the fragmentation of landholding. In India where equal distribution of inheritances to males is a common practice, the problem of land fragmentation is unavoidable. This works against the introduction of tubewells since a tube-well require a certain size of a plot for its economically efficient use.

Land consolidation is, therefore, a prerequisite for the introduction of tube-wells. The need for land consolidation has been stated since before independence, and attempts were made to consolidate land in colonial times in old Punjab, which included present Haryana. Such efforts become more intense after independence. The process of land consolidation was virtually completed in Punjab and Haryana in the 1960s, providing the foundation of the Green Revolution. Land consolidation also began in western Uttar Pradesh in 1955 and in the eastern part of the state in the 1960s. In Bihar and West Bengal, however, land consolidation has made

almost no progress. In addition, whereas land consolidation in Punjab, Haryana and Uttar Pradesh was done uniformly through the rectangulation of fields with parcels consisting of one-acre rectangles, in the eastern states of the Ganges it simply exchanged land with no regulations as to shape. When fields are rectangulated, it is easier to organize construct waterways along the field boundary, and to introduce tractors and other agricultural equipments.

We should also stress that rural electrification was fully achieved at an early stage, the middle of the 1970s, in Punjab and Haryana. In the eastern states of the Gangestic plains rural electrification is still halfway. This permitted the introduction of electric tube-wells whose running costs are cheaper than diesel tube-wells.

The differences in the progress of land consolidation between the western and eastern states of the Ganges can be explained by several factors. First, the dominant farmers in the western states are castes directly involved in agriculture, Sikh in Punjab and a farming cast of Jat in Haryana. In the eastern states, however, the landowners are mainly Brahman who have an aversion for direct involvement in farming. Furthermore, historically speaking independent farmers existed in the western states, but in the eastern states the zamindar system of large landholding was in place, complicating land ownership and impeding land consolidation.

**③ Changes in the agricultural situation: Labor shortage**

The Green Revolution greatly changed the agricultural scenery of northwestern India. The introduction of HYV rice in kharif, which was previously the secondary season, signified a rise in the intensity of cropping (total cropped area/net cropped area x 100). The intensity of cropping was about 130 in pre-HYV periods, but began to rise as soon as the Green Revolution started. It has now reached about 180. The rise of cropping intensity has resulted in seasonal labor shortages, as will be seen in detail later on.

Let us compare the farming calendar before and after the beginning of the Green Revolution. Before the advent of HYV rice, the general cropping pattern was to sow mainly wheat in rabi and minor grains in the secondary season of kharif, as already seen in Table 3. Wheat was sown in October to November and harvested in April or May. In kharif, such minor grains as bajra and millet which have a relatively short growth period of 90 days were sown, and only over a limited area. The harvest of such minor grains was completed at the beginning of October at the latest, leaving sufficient time for plowing when the sowing of wheat began before November. Wheat has to be sown before December, otherwise its yield drops sharply. The growth period of HYV rice which spread replacing minor grains is over 140 days. As a whole series of operations including the reaping and threshing of rice and plowing fields for sowing wheat is concentrated in a period of two months around November, a serious shortage of labor took place.

Figure 7 shows the changes in real agricultural daily-wages before and after the Green Revolution. Previously the peak of wages was in April, the wheat harvesting period, but with the spread of HYV rice new peaks appeared at the rice planting period in July and the rice harvesting period in November. In particular, wages became higher in the rice harvesting period than in the wheat harvesting period, showing that the peak labor demand shifted to November.

Here let us introduce the case of village N in Karnal district, Haryana, that we studied in 1981-82. This village had already achieved an irrigation ratio of virtually 100%, and all irrigation was done with tube-wells. A proportion of area under wheat and rice to total sown areas reached as high as 77.0% in the beginning of 1980s, higher than the current proportion of 70% in Punjab. In this village, agricultural wages were twice as high for the rice harvesting period than for the wheat harvesting period. The farmers of the village told us, "In the past we were busy during the wheat reaping season, but now we are busier in November". Now let us examine this labor shortage problem from two aspects: human labor and bullock labor.

Table 6 shows the human labor per acre required for different farming operations before and after the Green Revolution and when labor-substituting technologies such as tractor are used. The reason figures per acre instead of hectare are used is that, as explained above, one parcel consists of one acre due to land consolidation. The reaping and threshing of rice each requires 40 hours of human labor per acre. These operations must be finished in a shorter period of time before rice gets overripe and drops its grains. Such farming operations can not be done without relying on agricultural workers in the village. However, the demand for agricultural workers grew sharply with the spread of HYV rice. This induced seasonal migration from such poor states as Bihar, eastern Uttar Pradesh and Rajasthern. Though no data indicating the number of these migrants are available, today such migrants are indispensable for the agriculture in northwestern India. Considering that real agricultural wages have increased, and that two more peak seasons appeared due to the introduction of HYV rice, it can be said that the Green Revolution has positive employment effects for the agricultural workers, the poorest class of Indian agrarian societies.

Shortages have also arisen as to bullock labor (see Table 8). Before the Green Revolution, the peak periods of demand for bullock labor were the wheat sowing period in November and the wheat threshing period in April to May. Wheat used to be threshed by having bullocks pull stone or wooden lorries or bundles of bamboo. After the Green Revolution due to the introduction of mechanical threshers the demand for bullock in April to May was drastically reduced. However, the demand for bullock labor in October and November for plowing significantly increased with the expansion of area under wheat. Incidentally, rice is threshed by people striking rice bundles on drums or platforms, so this does not require bullock labor. The shortage of bullock labor in autumn was made decisive by the spread of HYV rice. The

fields must be plowed an average of five times for sowing wheat. Plowing one acre with a pair bullocks needs one day (8 hours). Another day is required for making rows with the plow and seeding the rows with wheat. Accordingly, six days are at least needed to sow one acre of wheat, even with the rather unrealistic assumption that the bullocks work every day without rest.

**Bullock labor presents the following three characteristics:**

(1) The number of bullocks that can be owned by a farm household is restricted by the number of workers who take care of bullocks and the amount of fodder obtained from the own fields. Therefore, the number of heads per farm household cannot be increased unrestrictedly in response to the demand. In northwest India, before the advent of tractors, approximately 80% of farm households owned only one pair of bullocks, which is a unit for plowing.

(2) If bullock labor is leased out, there is the risk that the bullock will be abused. So there is almost no lease market for bullock. This implies that the use of bullocks entails family labor. By the same token, agricultural workers in general are not employed for bullock using operations such as plowing and planting of wheat. Considering two discrete classes of landowners and landless workers of rural India, it is necessary to separate the demand for family labor and agricultural labor. For this purpose, whether or not the farming operation uses bullock labor is an important distinction.

(3) Whereas human labor from distant areas can be mobilized through migration, it is difficult to mobilize bullock labor from distant areas. These three attributes of bullock labor leave no room for doubt on the assumption that the shortage of labor tends to become more serious in bullock labor than human labor. This promotes the introduction of tractors that substitute bullock labor and hence family labor. Tractorization, however, increase the demand for hired labor mainly through the introduction of a labor intensive crop of rice.

Considering this increase in the demand for bullock labor in November and three attributes of bullock labor, if farm households owning one pair of bullocks sow rice and wheat over an area of 10 acres (4.05 hectares), it would take two months just for plowing and sowing for wheat in autumn. Consequently farm households may miss a timely sowing of wheat. Under the current situation in Punjab where rice occupies 60% of fields in kharif, a shortage of bullock labor takes place for households with 16 acres (4.48 hectares) or more of land. This induces the introduction of tractors in a wheat-rice two-crop zone.

### ④ Changes in rural society: the effects of tractorization

Northwestern India is known as the most advanced region in the mechanization of agriculture, such as wheat threshers, tube-wells and tractors. Note that these are bullock labor saving technologies. On the other hand, human labor saving technologies, such as

harvest-combines and rice planters, are not relevant.

As we have discussed, whereas the shortage of human labor can be covered with migrant workers, that of bullock labor will be a critical problem for the above-mentioned reasons. The result has been the introduction of tractors. Though we have no time series data for the number of tractors in Punjab, according to the agriculture census of 1978, the number of tractors per 1,000 hectares of cropped land was 12.43 in Punjab and 7.47 in Haryana, far over the Indian average of 1.87. Figure 9 shows the correlation between the proportion of area under wheat and rice to total cropped area as a proxy of the shortage of bullock labor and the number of tractors per unit area for Haryana at the district level. The significant positive association indicates that the shortage of bullock labor caused by the two-crop of wheat and rice is promoting the introduction of tractors.

The new farming technologies of the Green Revolution are, as a rule, scale-neutral. Therefore, contrary to the belief that large-scale farmers monopolize the benefits of new farming methods, in reality small-scale farmers have actually introduced HYVs more rapidly. When it comes to tractors, however, its diffusion is limited to the large-scale farmers. Tractors substitute bullock labor not only in plowing, but also in a wide range of operations such as sowing, threshing and transportation by equipping with seeding machines, threshers and carts (see Table 7). It should be noted, as was mentioned before, that tractors are family labor saving but hired labor using. Table 8 shows the operation-wise labor (family and hired labor) input per hectare for tractor farms and bullock farms for the district of Hisar in Haryana. As is clearly seen, tractor farms employ less family labor but more hired labor per unit of land than bullock farmers. Consequently, it can be concluded that the introduction of tractors increases the demand for hired labor and, hence, corrects the income disparity between the landowners and the landless agricultural workers. However, through the land lease market, the income disparity has increased for the reasons described below.

Sowing wheat is more effectively performed by tractors equipped with seeding machines than by sowing in rows made with plows. Consequently small-scale farmers who do not own tractors came to depend tractor-owners for sowing wheat in their fields. Also, since wheat threshers connected to tractor engines thresh wheat much cheaper than the conventional methods of threshing and winnowing using bullock and hired labor, small-scale farmers began to rely on tractor farmers for threshing. Tube-wells which is essential for introducing HYV rice replaced the bullock-using Persian wheels. Therefore for bullock farmers the only operation left for bullock labor is plowing. This made the cost of plowing with bullock labor prohibitively expensive. As a result, it turns out to be cheaper for bullock farmers, usually medium- and smallscale farmers, to ask tractor farmers to plow their fields. As a result, there appeared plow-less medium- and small-scale farmers. In village N in Karnal, there were 45 landowners, and of them 10 owned tractors. Of these, the smallest owned 12 acres of land (4.9

hectares). Only four small-scale farmers, having 10% of the village land, plowed their land using their bullocks. Remaining farmers relied on tractor farmers for plowing their land.

The ownership of a pair of bullocks and a plow used to be a necessary condition for leasing in land. Since large-scale farmers with constraints to bullock labor lease out land they could not cultivate by themselves, there was a flow of land leased out from large-scale farmers to small-scale farmers. The introduction of tractors, however, reversed this flow. Large-scale farmers, who owned tractors, were released from the restriction on plowing operations. They, then, ceased leasing out the land or even started to lease in land. According to a survey in the districts of Karnal and Hisar (Table 9), tractor farmers lease in land more actively than bullock farmers. Tractors changed the picture of tenurial relationships.

In conclusion, the introduction of tractors made it possible to activate the wage labor market and, hence, increased job opportunities for the rural poor. However, the introduction of tractors shrunk the land lease market because tractors enhanced the plowing competence of large-scale farmers. The introduction of tractors, therefore, influences the distribution of income in different ways; positive through the changes in the wage labor market and negative through the shrinkage of the land lease market. One may assume that the land lease market may not have shrunk if small-scale power tillers had been introduced as was the case in Japan in 1960s. However, the spread of irrigation gave rise to the phenomenon of "compactization" in which silt soil hardens in the dry season. Because of this, hardened soil could not be plowed with power tillers, and as a result it was necessary to introduce heavy tractors. Therefore, for the reasons explained above, the process of tractorization will likely not subside in the foreseeable future.

## (3) Conclusion

We have discussed the Green Revolution process in the granary of northwestern India. Most regions of India still remains largely plagued with poverty due to backward agriculture. Now we'd like to touch on some policy implications for agricultural development in backward regions from the experience of agricultural development in northwestern India.

One of the factors behind the agricultural development of northwestern India is that land had been well consolidated and that the region had favorable grand water resources for tube-wells. The use of tube-wells is determined by ground water resources. Vast regions of the eastern part of the Ganges plains, including Bihar, have the almost similar ground water resources as the northwest. The factor impeding their use is not a natural condition but rather social conditions that impedes land consolidation. Until this issue is resolved, investments in infrastructure focusing on irrigation will necessarily have little effect.

Though for the lack of space we have not sufficiently discussed the agricultural development in the southwestern part of Haryana where ground water resources are relatively poor. In spite of this unfavorable condition the region witnessed sufficient agricultural development compared to the Indian average. This is largely due to the fact that, with the proximity of the major consumption area of Delhi, vegetables and minor crops sown in the area turn out to be highly profitable. However, we should also note the fact that agricultural universities in Hisar and Ludhiana have developed seed varieties suited for the regions. Agriculture has more and more become technology intensive industry in the process of the Green Revolution. This corresponds to Japan's experience, where technological development in the early stages of development was carried out by entrepreneurial farmers known as Rono (veteran farmers) and, then, agricultural experiment stations played an important role in the later phase of development. Attempts should be taken to diffuse the improved varieties adapted in the semi-arid zone of southwestern Haryana to other region of India where irrigation facilities are not well developed.

## (4) Population of advanced rural areas

The states of Punjab and Haryana are advanced among the regions studied in this survey. This can easily be seen by comparing Tables 10 and 28. The various socioeconomic indices for Punjab and Haryana (per capita net domestic product, contraceptive prevalence rate, literacy rate and expectation of life for males and females) are better than for Bihar. Also, when we compare the socioeconomic indices of the two advanced states, it is easy to see that the values are better in Punjab than in Haryana. Thus, to rank the states in socioeconomic development terms, Punjab is first, Haryana second, Bihar third.

These demographic trends are reflected in the population growth rates of the two states. The population of Punjab rose from 17 million in 1981 to 20 million in 1991, which converted into an annual rate makes for a growth of 1.85%. The population of Haryana grew from 13 million in 1981 to 16 million in 1991, for an annual rate of 2.23%. In this way, we can observe the demographic rule that as the stage of socioeconomic development advances and the standard of living improves, the population growth rate decreases. The reason for this difference in the population area is that in Punjab where the per capita net domestic product is higher than in Haryana, the standard of living is higher, so the expectation of life is higher (in other words, the death rate, including infant mortality, is lower). Because of this, there is less of a need to have more children to take care of aged parents (refer to the infant survival hypothesis in Chapter 1, section 3), so the use of family planning increases and the birth rate is lower than in Haryana, resulting in a drop in the natural growth rate (the birth rate minus the

death rate).

We have now discussed the influence of socioeconomic development on population. However, such differences arising in population also have an effect on the people's standard of living. For example, to express the people's material standard of living in a straightforward manner, we can say that:

Standard of living = economic production ÷ population

If so, the standard of living in regions where the population is growing rapidly is necessarily lower than in regions where the population is only growing slowly. If we reverse the cause and effect relationship suggested in Tables 10 and 11 (that is, the effect of economic development and the standard of living on the population) and analogize the effect population has on economic development and the standard of living, we can say that the socioeconomic indices in Haryana where the population growth rate is high are worse than in Punjab.

This relationship between population and economic development on the one hand and the standard of living on the other naturally exists in both urban and rural areas. Table 12 shows the demographic indices for the urban and rural areas of Punjab and Haryana. We can see that the indices of birth rate, death rate and natural growth rate are all higher in rural than in urban areas. From these demographic indices we can easily infer that the standard of living is lower in rural than in urban areas, and that rural areas are suffering from poverty.

## 2 Situation in Less Developed Rural Areas

The state of Bihar consists of the alluvial plain in the Ganges basin in the north and the plateau in the south. It borders with Nepal to the north, Uttar Pradesh and Madhya Pradesh to the west, Orissa to the south and West Bengal to the east. With its favorable latent soil and climatic conditions necessary for agricultural development – fertile alluvial soil, relatively large rainfall, abundance water resources, etc. – it is a region in which farming is the main occupation.

Despite such favorable latent conditions, however, agricultural development in Bihar has not been satisfactory for the past 30 years.

For example, the land productivity of the major agricultural products in the first half of the 1960s was above the Indian average, and higher than Haryana, which in this study is considered a typical example of an advanced region [1]. After this, however, agricultural development stagnated, so the gap in productivity with advanced regions grew, and currently Bihar is one of the poorest states in all of India.

Bihar is also blessed with mineral resources. Attempts have been made to nurture heavy industry under governmental guidance, but because of the failure of the closed policy of import

substitute industrialization, the development of the mining sector has necessarily been limited, and completely insufficient for absorbing the rapidly growing labor population.

As a result of the high population growth rate indicated in the previous section and the above stagnation of economic development, the economy of Bihar fell into a so-called "low-level equilibrium trap" [2], and there has been no visible improvement in income levels. As a result, the problem of poverty remains one of the major issues for Bihar, as shown by the fact that 40% of the population is below the poverty line (see Table 10).

In this section we will study the stagnation of agriculture, the prime industry in Bihar, its reasons, and directions and issues concerning development strategy.

## (1) Current state of the stagnant agriculture of Bihar

Topographical and climatic conditions, the degree of development of different industries and irrigation conditions differ substantially from region to region, so here we will outline the following four agricultural regions as classified by the Raiendra Agricultural University (see Figure 11):

1 Northwestern alluvial plain ... West Champaran, East Champaran, Gopalganj, Siwan, Saran, Sitamarhi, Muzaffarpur, Vaishali, Madhubani, Darhanga and Samastipur

2 Northeastern alluvial plain ... Purna, Katihar, Saharsa, Begusarai, Monghyr and Bhalgalpur

3 Southwestern alluvial plain ... Gaya, Aurangabad, Rohtas, Bhojpur, Patna, Nalanda and Nawada

4 Chota Nagpur and Santhal Pargana plateau/hills ... Hazaribagh, Giridih, Santhal Pargans, Dhanbad, Palamau, Ranchi and Singhbhum

Of the four regions, the northwestern alluvial plain is the one with the highest population density. Productivity of food grains (particularly rice) is low, because rainfall is concentrated in the kharif season (the rainy season) from June to September so crops are easily damaged by floods, and because irrigation facilities are still not in place. The typical cropping pattern is to plant rice or maize in the kharif season, wheat and soya in the rabi (dry) season [3]. Industries other than agriculture are undeveloped, so the dependence on agriculture and forestry is high, and as high as 80% of the labor population is concentrated in the agricultural sector.

The northeastern alluvial plain has similar environmental conditions to the northwest, but is characterized by more rainfall (1,200 to 1,700 mm per year) and humidity, making it suited for the cultivation of rice and jute.

In the southwest alluvial plain there is less damage from floods than in the north, but because of the low rainfall (990 to 1,150 mm per year), it often experiences droughts. Within Bihar, this region has a long history of development, so the rate of irrigation and electrification is high. For rice, most areas have introduced HYVs, and land productivity is higher than other regions, and even higher than the East Indian average. The cropping pattern generally consists of rice in the kharif season, wheat and soya in the rabi season, but more beans are planted in the rabi season than in other regions. In addition, the non-agricultural sector is relatively developed in and around the state capital, Patna, so the percentage of the working population employed in the agricultural sector is lower than in the north.

The plateau and hill area of southern Bihar has poor soil and disadvantageous topographical conditions (slopes and high altitudes) so only 30% of the land area is used for agriculture. In addition, the irrigation rate is low and the productivity of rice and other grains is extremely low. Thus, with such low agricultural productivity and low capacity for population sustenance, the population density of this region is the lowest of the four. However, the region has mineral resources (iron ore, bauxite, manganese, etc.), so such industries as mining and quarrying are developed, and the ratio of the working population employed in these industries is high.

From the above we can see that agriculture in Bihar consists mainly in the production of grains in the alluvial plains of the Ganges basin. Next, let us examine the recent trends in agricultural production in terms of land utilization, social infrastructure and investments in production elements, using several indices related to agricultural production.

Table 13 shows the changes in the cropped area for major crops. According to this table, rice accounts for 50% of the total, wheat, the major crop in the rabi season, for 20%, and beans and maize for under 20%. Thus, these food crops alone account for nearly 90% of the total, indicating the importance of food production in Bihar.

Next, Table 14 and 15 show the status of the social infrastructure necessary for agricultural production, in this case only the supply of electricity for irrigation. The percentage of irrigated area (in 1990-91) was an average of 40% for all crops and 85.5% for wheat, both slightly higher than the average level for all of India, but only 36.4% for rice, the most important crop, thus lower than the Indian average. In addition, to look at the supply of electricity, essential for the spread of tube well irrigation, using the per capita electric consumption as an index, the level in Bihar is low – one third the Indian average, and one seventh and one fifth respectively for the advanced agricultural states of Punjab and Haryana.

In this way, because of the lag in agriculture-related social infrastructure, the use of institutional source of credit and the introduction of such modern technologies as chemicals and agricultural machinery is necessary limited. Table 16 shows the use of chemical fertilizers per hectare of farmland (1992-93). The figure for Bihar is lower than the Indian average, one

third that of Punjab and one half that of Haryana. Also, when we look at the mechanization of agriculture in the number of agricultural machines used per male worker, the figure is far lower in Bihar than in Punjab and Haryana (see Table 17). Furthermore, Table 18 shows that the use of institutional finance for agriculture (1992-93) is extremely low in Bihar – while Punjab and Haryana each account for over 10% of the total for India, Bihar, which has a far larger agricultural population, only accounts for 2% of the total. In Bihar, the use of HYVs is only 30% for rice, which accounts for half of the cropped area (see Table 19). This is extremely low compared to Punjab and Haryana, where HYVs are used for 100% of the rice crop.

In this way, as a result of the lag in establishment of infrastructure and the lack of progress in introducing modern technologies, improvements in agricultural production and productivity in Bihar have been extremely slow over the past 30 years. This trend is indicated on Figure 12. Since the 1960s, land productivity and total production have tended to increase greatly for wheat and maize. The productivity of maize in particular is higher than the national average. By contrast, both the land productivity and the total production of rice was increasing though slowly through the 1980s, but has begun dropping in the 1990s, with the average for 1991-92 and 1992-93 falling to the level of the beginning of the 1960s.

## (2) Factors hindering agricultural development [4)]

Some important restrictive conditions hindering the development of agriculture in Bihar are: ① the social and economic agrarian structure; ② the harsh natural environmental conditions; ③ the inefficiency and lack of staff in the public sector; and ④ the difficulties in management and development of water resources related to the first three conditions. We will now take a look at each of these.

### ① Social and economic agrarian structure

The subsistence of a "semi-feudal" agrarian structure in rural areas is often mentioned when explaining the low development of Bihar. Under the land tax levy system set up in British colonial times in former Bengal, which includes present day Bihar, private ownership of farmland by large landowners who dominated the rural areas (zamindar) was admitted, unlike in Punjab and other regions, and these landowners were under the obligation to pay taxes. The zamindar lent land to farmers, levied tenancy rents from them, and used this to pay their land taxes. With the growth of the population of Bengal, the demand for farmland also grew, so the level of tenancy rents rose and the income level of tenant farmers decreased. People who could not access farmland became agricultural workers and formed the lowest class in rural areas. Through this process a feudal relationship of dominance and subservience

was formed between the large landowners and the tenant farmers and agricultural workers. Under this system, the land-owning class used the levy of tenancy rents and interest from debts to exploit surplus agricultural production, and instead of investing this in improving agricultural productivity spent it to display their social status or to purchase more occupation right of land. As a result, agricultural productivity stagnated under the zamindar system and improvements in agricultural productivity were extremely limited [5].

After independence, land reform laws were enacted in India abolishing the zamindar system and reforming the tenancy system. These laws were also applied to Bihar. However, land reform in Bihar was incomplete, and the former zamindar were able to retain much of their self-worked land. As a result, the feudal relationship between the large landowners and the tenant farmers and agricultural workers was preserved, and improvements in agricultural productivity could only be gradual.

The reasons that agricultural productivity does not improve under these "semi-feudal" agricultural relationships can be interpreted as follows:

a) Landowners and the wealthy use their status as sole suppliers of farmland and exploit the economic surplus of tenant farmers and agricultural workers through tenancy rents, etc., while at the same time giving them consumption credit and earning interest income from it. If agricultural productivity rose and the poor classes managed to acquire an economic surplus, the landowners and the wealthy would not be able to make an interest income from consumption credit, and their losses would be greater than the benefits from improved agricultural productivity, so they do not invest in agriculture [6].
b) Landowners and the wealthy have other occupations in addition to agriculture, and rather than making investments for intensification and multiple-cropping, keeping a single crop and spending the rest of the time for their other occupations provides greater overall profits, so they do not invest in agricultural production [7].
c) Landowners and the wealthy are often the political dominators of the area. In order to maintain their politic support base and influence it is better not to increase agricultural productivity and to maintain the semi-feudal relationship of dominance and subservience.

Many counter arguments have been made to such theories explaining the backwardness of agriculture in Bihar through the social and economic structure of rural areas, and no settlement has been reached in this debate, which we could call the debate on Indian capitalism [8]. Whether or not the relationship between landowners and the wealthy is "semi-feudal" is an important point when considering the directions of development policies, but we will not debate the issue any further here.

Whichever stance we take, it is unarguable that such characteristics of agriculture in Bihar as the small scale of land worked and the fragmentation of plots are restrictive conditions to the improvement of agricultural productivity. Table 20 shows the size distribution of operated

farm land in Bihar. We can see that small farmers operating plots of 2 hectares or less account for nearly 70% of the total in number and under 50% in area, while large farmers 10 hectares of more of land account for 0.4% in number and 7.7% in area. The average farm size of large farmers is 16 hectares. This size is smaller than the Indian average and the average of other states. Also, the average farm size of whole farmers is 0.93 hectares. This is smaller not only than the Indian average but also than the average of eastern India, indicating the petty farming in Bihar. In addition to the pettiness of land holding, the fragmentation of plots is proceeding, and this trend is particularly distinct among small scale farmers (see Table 21).

The small size of land operated and the fragmentation of plots act as factors hindering investments by small farmers, by for example making it difficult to procure investment capital and making it impossible to acquire the profits from irrigation investment, as will be explained later.

The above-mentioned farmland reform laws reformed the tenancy system with the aim of creating independent farmers and attempted to protect tenancy rights, to reduce tenancy rents and to establish fixed rent tenancy system, thereby enabling tenant farmers to acquire tenancy land. However, although these laws created a large amount of owner cultivators, many zamindar took back their tenancy land with the pretense of cultivating it by themselves, expelling tenant farmers or rented their land illegally, maintaining a permanent labor system or a tenancy system distinguished by low wage rates or high tenancy rents and insecure tenancy rights (see Table 22). Like the small size of land operated and the fragmentation of plots, this insecurity tenancy of farming rights and high sharing rates are factors hindering investments in agriculture by tenant farmers.

### ② Harsh natural environmental conditions

As previously mentioned, the annual precipitation in this region is not low, but the pattern of rainfall in the rainy season is extremely unstable. Often after a certain period of rain it will not rain for long intervals. This is a serious problem for agricultural production.

In addition, there is frequent flooding in the region of 1.7 million hectares in the north, while the southern areas often suffer from drought. Furthermore, damage from blight and harmful insects is great, with some 15 to 20% of the total annual harvest suffering damage. Because of this environment in which agriculture is easily affected by natural disasters, the risk in investing to improve agricultural production is great, diminishing the will of farmers to invest.

In addition, in the Ganges basin there are some 80,000 hectares of what are called "Tal" lands on which sand is accumulated due to the annual floods, and under the current conditions it is impossible to grow there during the rainy season. Part of northern Bihar suffers from the problem of saline soil, while a vast region of the Chota Nagpur plateau in the south suffers

from the problems of acidic soil and erosion. The establishment of agricultural systems in such disadvantaged areas requires vast expenses and effort.

**③ Inefficiency and lack of staff in the public sector**

The role of the public sector is important for such agricultural development projects with a strong public character as the establishment of infrastructure, research, development and extension. The inefficiency and the lack of staff of the public sector is acting as a hindrance for establishing the basic conditions for agricultural development in Bihar.

The introduction of such modern elements as improved seeds, chemical fertilizers and pesticides is essential for the use of modern agricultural techniques.

The supply of good quality improved seeds by public organs is essential for achieving high yields under poor environmental conditions, but there is a shortage in the supply of improved seeds within the state because Bihar lacks raising seedling etc., and the seed regeneration rate is extremely low.

Improved seeds, chemical fertilizers and pesticides are in many cases distributed through cooperative union organizations organized by the state government (such as the Bihar State Co-operative Marketing Union or BISCOMAUN), but there are union distribution offices only at the level of blocks, the administrative unit below districts, so actually distribution to the 100 to 200 villages in each block is insufficient. Furthermore, the lack of goods and the distribution plans often lead to such problems as the mixing in of poor quality goods and the inability for farmers to obtain the required amount of goods at the necessary time.

The supply of electricity is another important job of the state government, but the management and administration of electric projects by the government is inefficient, and there are often shortages of electricity or unstable supply. The supply of electricity is necessary for well irrigation using tube wells, but the inefficient management and administration in the supply of electricity is hampering the development of irrigation. Furthermore, there are often large-scale thefts of power lines, transformers, etc., making the progress in electricity development that much more difficult.

Bihar has introduced a T&V (Training and Visiting) system in which personnel visit farms to offer farmers guidance on the spread of agricultural technology, but because of the lack of staff, the personnel must spend much of the time on activities related to agricultural development other than the spread of agricultural technology (such as guidance on family planning, public hygiene, etc.), and is not able to sufficiently perform its original task, that is the spread of new techniques. In addition, concerning research and development of techniques, the staff for the applied research and the field staff necessary for developing and applying techniques suited for the region are insufficient and coordination between research organizations at agricultural universities, etc., and the administrative organizations in charge

of diffusion is poor, and these factors act as restrictive conditions for the development and spread of new techniques suited for the conditions of the region.

There is a lack of the social capital and facilities (storage and processing facilities, roads, railroads and markets) necessary for the efficient distribution of such perishables as fruits and vegetables, and farmers are often forced to sell their produce to merchants at unfairly low prices. Without the establishment of such social capital and the organization of farmers in the area of distribution, factors which should be dealt with by the public sector, the desire of small farmers to improve productivity will be reduced.

**④ Restrictions in the management and development of water resources**

To look at the irrigated area of Bihar by water source, we can classify water sources into water canals, reservoirs, tube wells using electric pumps, traditional wells, and others, accounting respectively for 33.7%, 3.3%, 41.8%, 3.7% and 17.5% of the total in 1990-91. From these percentages, we can see that irrigation from water channels and tube well irrigation using electric pumps are important.

In principle, state governments manage large- and medium-scale river irrigation. In Bihar, there is strong mutual mistrust between bureaucracy and farmers due to the inefficiency of irrigation administration. Problems include water not reaching the final destination due to the lack of diversion channels, inequalities in the distribution of water according to the distance from the river or main water channel, farmers not being able to use the necessary amount of water at the necessary time because water supply times and amounts are decided by the government, and delays in repairs to water canals. In Bihar, a system by which the construction, upkeep and management of water canals from the diversion canals downstream is entrusted to the village panchayat has been established in an attempt to avoid such problems. However, an orderly form of water use and organized action are essential for such community level operations for increasing the efficiency of use of irrigation facilities as the repair of water canals, the preparation of land and land consolidation, but in general it is difficult to adjust the interests between farmers, so such operations are not running smoothly.

River irrigation cannot be expected to develop because the above types of problems act as restrictive conditions, so since the 3rd Plan the state government has shifted the emphasis for the development of water resources towards the development of tube well irrigation employing untapped ground water resources.

There are two major types of tube well irrigation: relatively large scale deep tube well irrigation potentially benefiting areas of 80 to 100 hectares constructed by the state government, and shallow tube well irrigation potentially benefiting areas of approximately 10 hectares and built mostly by the private sector.

The use of deep tube well irrigation facilities controlled by the state government has been

decreasing due to the inefficiency of the irrigation administration and the difficulties in adjusting interests between farmers, as with river irrigation (see Table 25).

Private shallow tube well irrigation, on the other hand, offers such advantages over other irrigation methods as: ⓐ construction and maintenance costs are low (see Table 26); ⓑ they are labor-using facilities so they save energy; ⓒ they are suited for irrigating small areas because the area they benefit is small; ⓓ farmers can use the amount of water they need at the times they need; and ⓔ the water channels are short so there is little loss from water permeating the soil or evaporating in the air. Thus, private shallow tube well irrigation can be considered appropriate for small-scale farming. However, as mentioned previously, the small size of land operated and the fragmentation of plots has progressed to an extreme degree in Bihar, so for many small farmers the farm size they operate is below the appropriate size necessary for investing in tube well irrigation. In addition, they must receive financing of capital in order to invest in irrigation, but this is difficult for such reasons as the small size of land owned serving as their asset basis and the instability of farming rights. Furthermore, the increasingly small size of land worked and the fragmentation of plots makes it even more difficult to achieve an orderly form of water use for irrigation and drainage.

## (3) Directions and issues for agricultural development in Bihar

From the above considerations, we can sum up the basic issues for the agricultural development of Bihar as follows.

First, such factors in the structure of agriculture as the small size of land worked, the fragmentation of plots and the instability of farming rights are hindering investments for improving agricultural productivity, for example in irrigation development, and eliminating these factors is the most fundamental condition for agricultural development. Thus, it is necessary to study measures to promote the redistribution of farm land, land consolidation and the organization of small farmers. An awareness of this can already be seen in the Indian government's 7th Plan, which demonstrates the thinking that: ⓐ the redistribution of farm land will give the landless and small farmers the asset basis necessary for procuring financing for their economic activities; and ⓑ measures such as land consolidation, the management of fields, the protection of farming rights and the correction of land registers will facilitate the adoption of modern agricultural techniques by farmers and contribute to improving agricultural productivity [9]. The problem is the possibility of these land measures being implemented. Resistance from the vested interests can be expected with respect to the redistribution of land and the protection of farming rights. Furthermore, it will not be simple to adjust interests between farmers on land consolidation [10]. Thus, we can say that whether or not

these land measures are implemented successfully will depend to a major extent on the objective of the improvement of social capital discussed below, as well as on the will of governmental leaders and the capabilities of the administrative organs in charge of the actual work in the field.

Next, the establishment of irrigation facilities and the development of electricity necessary are essential for making land measures effective and for spreading new farming techniques.

As discussed above, for the development of agriculture in Bihar, stress is being placed on ground water resources, and in particular on shallow tube well irrigation with its relatively low costs and high suitability for small farmers. The state government has decided to offer subsidies of 45 to 100% (75 to 90% for ultra-small and small farmers) for private investments in tube well irrigation, but because of the shortage of financial capital due to the cuts in aid from the central government, implementation of this program will necessarily be delayed substantially [11].

Thirdly, even if land measures and the development of water and energy resources are implemented, in order to develop and spread agricultural techniques with high productivity suited for the environmental conditions of the region, it will also be necessary to improve research staffs in both quantity and quality, strengthen cooperation between research and extension organizations, train extension personnel, etc. Given the importance of the rice crop and its low development in Bihar, it may be a good idea to consider setting up a rice research and educational facility at an agricultural university which can both develop and renew varieties suited for the agricultural environment of the region and train technical guidance personnel (such as the Philippine Rice Research Institute built with the support of JICA). In addition, in order to conduct agricultural and rural development in a comprehensive fashion, such reforms to administrative organization as the correction of the vertically split administration within administrative organizations and coordination between departments should also be conducted simultaneously.

Because agricultural development cannot be achieved if even one of such basic development strategies – that is land measures, the development of water and energy resources, the improvement of research, development and extension personnel, and the increased efficiency of administrative organizations – is missing, it is necessary that they all be conducted at the same time.

In addition, in hilly regions and regions without water resources, rather than intensifying the rice crop it is probably better to consider the production and development of other crops. When doing so, it would be rational to place emphasis on the production and development of fruits and vegetables for export and processing, considering the possibilities of expansion of the potential demand. Fortunately, the production of such export-competitive crops as onions,

tomatoes, mangos, litchis and potatoes is high in Bihar [12]. Thus, attempts should be made to improve the social capital and equipment needed for increasing the production of these crops, such as roads, railways, and processing and storage facilities, and to increase research and development projects for improving their quality.

We have now discussed the general issues and directions of agricultural development in Bihar. Finally we would like to point out some more concrete issues for agricultural development in the different region by region.

**① Northwestern alluvial plain**

ⓐ In areas which are frequently flooded and cropping is not possible in the kharif season, there is a trend for shifting the cultivation of maize from the kharif to the rabi season. Thus, it is necessary to develop HYVs for the maize crop in the rabi season.

ⓑ Development of varieties of rice less subject to damage by floods, wheat resistant to drought, sugarcane resistant to red rot, rapeseed and mustard resistant to plant lice, gram and hatomame suited for the soil conditions of the northwestern alluvial plain, etc.

ⓒ Improvement to the salty soil in the districts of Saran, Siwan and Vaishali.

**② Northeastern alluvial plain**

Drainage measures for frequently flooded areas such as Saharsa and Kosi, and development of varieties of rice resistant to floods in the kharif season.

**③ Southwestern alluvial plain**

ⓐ Same flood measures as for the northwest.

ⓑ Improvements to farm land for agricultural production on "Tal" lands.

ⓒ Development of varieties of fast-growing maize which can be harvested before floods.

ⓓ Earlier planting of wheat in the rabi season and development of HYV of rice with short growth periods to minimize damage due to drought.

ⓔ In arid zones, tests for the applicability of crops resistant to drought (citrus fruits, guava, pomegranate, custard apple, cashew nut)

**④ Chota Nagpur and Santhal Pargana plateau/hills**

ⓐ Development of varieties of rice and ragi resistant to drought.

ⓑ Construction of irrigation facilities using pumps and check dams for medium- and small-scale river irrigation.

ⓒ Introduction of rabi crops suited for rainwater farming.

### (4) Population of low-development rural areas

As we can easily understand from a comparison of the socioeconomic indices of Punjab and Haryana and those of Bihar (see Table 28), Punjab corresponds to a low-development region within the regions studied for this survey. The socioeconomic indices for Bihar (per capita net domestic product, contraceptive prevalence rate, literacy rate and expectation of life) are all lower than for Punjab and Haryana. Considering these indices, we can infer that Bihar has fallen into the vicious circle in the cause and effect relationship between economic development and the standard of living on the one hand and population on the other. That is, the population growth rate is high due to the low economic development and standard of living, while economic development and the standard of living are low due to the high population growth rate (see Chapter 3 section 1-(1)). In fact, the birth rate, death rate and natural growth rate in Bihar are all higher than the levels in Punjab and Haryana (see Table 29).

In other words, the rapidly growing population of Bihar is an obstacle to economic development and improvements in the standard of living in Bihar. This cause and effect relationship can also be seen in the relationship between urban and rural areas, as mentioned in the previous section. Table 30 shows that the birth rate, death rate and natural growth rate in Bihar are higher in rural than in urban areas.

## 3 Comparative Analysis of Agriculturally Advanced and Backward Regions

T. W. Schults classified agricultural problem into the "food problem" particular to developing countries and the "farm problem" particular to developed countries. The farm problem consists in the relative decrease in the profitability of the agricultural sector compared to the industrial sector due to excess investments in resources to the agricultural sector. The food problem, on the other hand, is the mechanism by which food prices rise without a sufficient increase in food production to meet the increasing demand caused by the growth of population and incomes in the early stages of industrialization. This results a rise in real wages and, consequently, frustrated industrialization. This logic is known as the Ricardian growth trap pointed out in relation to the industrial revolution in England.

Aside from the countries of North America and Oceania with their abundant land resources, historically speaking, the food problem was also experienced by advanced countries in the initial stages of modern economic growth. This problem was solved in Europe through the import of cheap wheat from the New World, and in Japan through the import of rice form the Korean peninsula and Taiwan, then under colonial rule. Present developing countries,

however no longer have such choice. In addition, developing countries are afflicted with higher population growth rates that developing countries had experienced in their early stages of economic development. As the result, present developing food problems far more serious than those experienced in developed countries. Attempting to rely on food imports restricts the import of capital goods and technology owing to shortages of foreign currency, resulting in a frustration of industrialization. This is nothing other than the Ricardian growth trap. In fact, after the severe drought in the mid-1960s in India, an increase in foodgrain imports caused a foreign currency crisis, resulting in a long-term stagnation of the industrial sector. Accordingly the only choice today's developing countries have if they are to continue the process of industrialization without falling into the Ricardian growth trap is to increase domestic agricultural production through improvements in agricultural technologies.

As discussed in section 1, the Green Revolution centered in northwestern India resulted in a drastic increase in foodgrain production. Consequently India achieved self-sufficiency for foodgrains at least in the sense that it no longer had to rely on foodgrain imports. We can say that India was able to escape from the Ricardian growth trap, at least for the time being.

However, there ate three points to be considered concerning India's future agricultural issues. First, even though India has managed to escape from dependence on foodgrain imports, there is no guarantee that it will not face foodgrain shortages again in the future. Actually, though the population growth rate slows down, it still remains high. Because of the above considerations, we cannot reject the possibility that India will be once again caught in the food problem. Though the Green Revolution was introduced successfully in regions with sufficient irrigation facilities and other aspects of agricultural infrastructure, there are no longer any regions left in the country with the same potential. If the Green Revolution is to be promoted in the future, it has to be carried out in the regions that require vast investments in agricultural infrastructure. Secondly, as can be easily conferred from the fact that the Green Revolution took place in the regions whose agricultural infrastructure was well developed, regional disparities in agricultural development have widened. Agriculturally advanced regions, such as Punjab and Haryana, have to face with the farm problem of the type experienced by developed countries. In the regions the decrease of agricultural profits come to be apparent due to reductions in agricultural subsidies and the changing sectoral terms of trade against the agricultural sector. By contrast, in Bihar and most other regions, the food problem remains serious. India's diversity is reflected in the agricultural sector as well, especially in the sense of the coexistence of the farm and food problems. It is, therefore, necessary to adopt distinct agricultural policies to deal with different situations. The reason that for this survey we chose the advanced agricultural regions of Punjab and Haryana and Bihar as a typical backward region is exactly because we had this situation in mind. Thirdly, in addition to the regional disparity, there is also the problem of income disparity within regions.

In this section we will: 1) compare the situation in agriculturally advanced and backward regions; and 2) examine policy implications by extracting the factors determine these differences.

## (1) Disparity between and within regions

It goes without saying that India is a diverse nation, and no meaningful implications can be expected unless policies consider this diversity of Indian agriculture. The regions studies in this survey lie within the so-called Hindi belt in the Gangestic plains. By classification of agricultural regions (see Figure 13), Punjab and Haryana are situated in the trans-Gangestic plains, while Bihar is located in the middle Gangestic plains, Uttar Pradesh in the upper Gangestic plains, and west sengal in the lower Gangestic plains. In this section we will focus our discussion on these five states in the Gangestic plains.

**Regional disparity**

The Green Revolution was successful in the western Gangestic plains, in the states of Punjab and Haryana and in western Uttar Pradesh. It did not have conspicuous results in the eastern Gangestic plains extending from eastern Uttar Pradesh down river. In addition, by cropping pattern (see Table 31), the principal crop is wheat in the western Gangetic plains, rice in the eastern Gangestic plains. As is already discussed, however, HYV rice was introduced mainly in the western Gangestic plains, forming a two-crop zone of wheat and rice. The land productivity of rice here is two to three times higher than in the rice-growing zone of the eastern Ganges states. Therefore, for our discussion we can divide the Hidi belt into two major sections, the western Gangetic plains and the eastern Gangestic plains. Of course, in this report these regions are represented by Punjab and Haryana for the former, Bihar for the later.

Concerning the size of the population (see Table 32), the population of Punjab is about the same as that of Taiwan, while the population of Bihar is far greater than that of Thailand and Vietnam. The population of Uttar Pradesh is larger than that of Japan. Though only states, they have populations equal to those of countries, and this fact demonstrates the need to discuss India by region.

The per capita income is higher in the western Gangestic plains, lower in the eastern plains. This fact can be seen from Table 34, which shows the percentage of the population below the poverty line. The poverty line is defined as the expenditure needed for adult males to obtain a daily caloric intake of 2,400 calories in rural areas and 2,100 calories in urban areas. Families which cannot afford this expenditure are considered to be under the poverty line. For India as a whole, the percentage of the population below the poverty line is decreasing since

the independence. Bihar, however, has the highest percentage of people under the poverty line after Orissa. By contrast, in Punjab the percentage has already dropped into the single digits. This clearly indicates the implication of India's attainment of self-sufficiency in food grains. That is, achieving self-sufficiency in foodgrains only means that foodgrains do not have to be imported, and a vast population under the poverty line still exists. No matter how optimistic reports on indian agriculture today may be, the food problem remains one of the most serious issues facing India.

The interstate movement of foodgrains is shown in Table 33. The states that are net exporters of foodgrains are the western Gangestic states of Punjab, Haryana and Uttar Pradesh, where the Green Revolution took place vigorously. Other states are more or less marginal states whose net imports or exports are negligible. It is, therefore, no exaggeration to state that the granary of the northwest, the western part of gangestic plains, is feeding the rest of India. By contrast, Bihar and West Bengal in the eastern Gangestic plains depend on large quantities of foodgrain imports from other states. Considering that West Bengal has the large consumption area of Calcutta, we can understand the seriousness of the situation in Bihar, which has no particular large industrial cities. Bihar is forced to export labor in order to maintain such large imports of foodgrains. in the past this took the form of labor migration to cities. For example, many of the professions in the informal sector of Calcutta, such as construction workers and rickshaw pullers, are occupied by Bihar natives. With the progress of the Green Revolution, however, seasonal migration as agricultural workers to northwestern India has increased rapidly. This suggests that agriculture can be promising in creating employment opportunities, and that agricultural development in such poor states as Bihar will not only solve the food problem of the region but also provide employment opportunities for the many people living under the poverty line.

**Income disparities within regions**

Rural India is made up of two major classes: landowners and landless households. The latter accounts for approximately 30% of the rural population. They are in general people from the lower castes who earn their income as agricultural workers or rural workers involved in various occupations. Let us look at the percentage of the population below the poverty line by the class (Table 35). The situation is most severe in Bihar and West Bengal, where over 70% of agricultural workers are below the poverty line. Agricultural policies must take into consideration the existence of this poorest class of people who do not own land: that is a need for labor-intensive farming methods. Incidentally the percentage of landowners below the poverty line in Bihar and West Bengal is also near 40%, higher than the percentage for agricultural workers and rural workers in Punjab and Haryana. This clearly suggests the seriousness of regional disparity.

## (2) Factors behind the regional disparity and policy implications

The introduction of modern inputs such as HYV seeds, chemical fertilizers and irrigation are essential for the progress of the Green Revolution. These are in fact in a complementary relationship, and without one or the other the Green Revolution could not progress.

Table 36 compares production costs for the rice crop in the agriculturally advanced states of Punjab and Haryana and the backward state of Bihar. From this table many policy implications can be suggested. The labor input per unit area is higher in the advanced states. Though there is little difference in family labor input, the dependence on hired labor in the advanced states double that of Bihar. This is because the mechanization of agriculture substituted family labor in the advanced states. This shows that the Green Revolution is hired labor using, providing employment opportunities for the rural poor. Behind this are the facts that, as we have already seen, in the advanced states the percentage of landless below the poverty line is relatively low, and there is a large flow of seasonal migrants from Bihar to northwestern India. When we consider the large numbers of the poor in rural India, hire-labor intensive nature of the Green Revolution is the most appropriate technological characteristic. The Green Revolution may solve not only India's food problem but also solve the poverty problem to a larger extent.

The next issue is a question what hinders the progress of the Green Revolution. Chemical fertilizers are used approximately three times more in the advanced regions than in the backward region (Table 36). This does not mean, however, that there is a simply increase the application of chemical fertilizers in the backward region. This is because of the complementary nature of modern inputs. Without adequate irrigation facilities the use of chemical fertilizers would not be effective. Table 37 shows that the irrigation rate is high in the advanced agricultural states of Punjab and Haryana, but only 40% in the backward state of Bihar. In addition, the quality of irrigation differs between the two regions. While tube-wells is relevant in the advanced states, they are not spread in Bihar. From this fact we can infer that the gap in irrigation costs (see Table 36) is even wider than the gap expressed by the ratio. Therefore it can be concluded that the poor irrigation in Bihar acts as a hindrance to the progress of the Green Revolution.

An immediate question here is what explains the delay in the spread of tube-wells in the agriculturally backward region. First, considering the suitable size of plot for the use of tube-wells, conditions are unfavorable in the backward region. Not only is the average size of land in the backward region one third that of the advanced region. In addition, due to the differences in the progress of land consolidation the size of plot is extremely small in the backward region. This strongly hinders the efficient use of tube-wells. Secondly, the delay in rural electrification is a crucial factor. In the agriculturally advanced state, rural electrification

was virtually achieved by the mid-1970s. This promoted the introduction of tube-wells. By contrast, the rural electrification rate in the agriculturally backward region is just barely over 50% (see Table 37). Tube-wells could be used with diesel fuel, but this involves higher running costs.

We have now compared the agriculturally advanced and backward regions. From the viewpoint of natural environmental conditions, they are not conspicuously more restrictive in the agriculturally backward region. The gaps in agricultural development between the two are due mainly to the different degrees of progress of the Green Revolution. This difference is determined primarily by the different levels of infrastructure. From the perspective of Japan's international contributions, Japan can hardly be directly involved in land consolidation. Instead, the development of such elements of agricultural infrastructure as rural electrification and canal irrigation facilities and the supply of inexpensive chemical fertilizers should be considered as effective targets for assistance.

## (3) Population

We have now observed the population situation in the advanced region of Punjab and Haryana and the backward region of Bihar. As a result, we can sum up the population situation in India as follows:

a) The population situation for India as a whole is proceeding along the lines of the demographic transition theory (by which as the stage of socioeconomic development advances and the standard of living rises, population situation shifts from high birth and death rates towards low birth and death rates).
b) The relationship between economy and population can also be seen regionally. That is, regions at more advanced states of development and with higher standards of living have lower population growth rates. Conversely speaking, regions with higher population growth rates have lower levels of socioeconomic development and living standards.
c) This is due to the causal relationship explaining the child survival hypothesis (by which the level of the death rate, including the infant mortality rate, determines the level of the birth rate when the parents must depend on their children for support in their old age). That is, if the standard of living is low because of the low stage of development, the infant mortality rate must rise, and couples have many children in order to ensure their livelihood in their old age, so the birth rate of the society as a whole rises.
d) In national terms, demographic transition in India, particularly from the perspective of the population growth rate, cannot be said to be very advanced. In addition, when we look at the expectation of life for males and females by region, in the regions studied in this survey

the average life expectancy is either slightly longer for men or virtually equal for men and women (see the Tables 10 and 28 at the end of this chapter). According to demographic rules, the difference in the expectation of life between males and females increases as socioeconomic development progresses, and in today's developed countries in general is about five years longer for women than for men. There is no doubt that the population situation in India is progressing along the lines of the demographic transition theory, but this progression is quite slow on both the national and regional levels.

e) On both the national level and in the regional sense, one of the major factors for the many socioeconomic problems of India is this slow progress of demographic transition.

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## Notes:

1) See Bhalla and Thagi (1989).
2) Concerning the "low-level equilibrium trap", see Leibenstein (1954) and Nelson (1956).
3) There are two types of rice crops in the kharif season, the fall crop (April to August) and winter crop (August to December). In Bihar, the latter is more common.
4) Concerning the descriptions in this section, we have referred to oral surveys by the writers as well as Reserve Bank of India (1984), Sharma and Gupta (1987), Bardhan (1984), and Nishiguchi/Hamaguchi (1986).
5) See Sharma (1987).
6) Hypothesis of Bhadyri (1973).
7) Assertion of Prasad (1976).
8) Concerning this debate, see Bardhan (1984) chapter 12.
9) Gov. of India, Planning Commission, The Seventh Plan 1985-90.
10) AICAF (1989) chapter 3.
11) From oral interviews with the staff at the Bihar state government's Water Resource Department.
12) Concerning export competitiveness, see Table 27.

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## Table 1 Contributions to Procurment

(%)

| | Punjab | | Haryana | |
|---|---|---|---|---|
| | Wheat | Rice | Wheat | Rice |
| 1989/90 | 56.0 | 50.0 | 21.9 | 20.6 |
| 1990/91 | 67.4 | 48.2 | 23.4 | 19.9 |
| 1991/92 | 55.4 | 42.5 | 23.7 | 25.4 |
| 1992/93 | 44.9 | 49.0 | 21.5 | 19.9 |

Source : Government of Punjab, *Statistical Abstract of Punjab 1993*, Economic Adviser to Government of Punjab, Chandigarh, 1994, and Government of Haryana, *Statistical Abstract of Haryana 1992/93*, Economic and Statistical Organization, Chandigarh, 1994.

# Table 2 Basic Data on the Indian Economy

| Year | Daily per capita grain consumption (grams) | Net imports of grain (million tonnes) | Food/general consumer price index | Reserve in foreign currency/amount of imports | Shares of total amount of imports | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Machinery (%) | Grains (%) (A) | Chemical fertilizers (%) (B) | (A)+(B) |
| 57/58 | 408.0 | 3.17 | 100.0 | 0.246 | 28.6 | 5.6 | 0.7 | 6.3 |
| 58/59 | 467.5 | 3.80 | 100.1 | 0.244 | 27.7 | 20.0 | 1.2 | 21.2 |
| 59/60 | 447.4 | 5.05 | 100.0 | 0.264 | 29.1 | 15.6 | 1.9 | 17.5 |
| 60/61 | 468.7 | 3.49 | 104.8 | 0.168 | 29.2 | 15.9 | 1.1 | 17.0 |
| 61/62 | 460.9 | 3.64 | 104.7 | 0.180 | 27.3 | 10.6 | 1.4 | 12.0 |
| 62/63 | 443.8 | 4.55 | 106.4 | 0.164 | 28.4 | 12.7 | 2.7 | 15.4 |
| 63/64 | 452.0 | 6.26 | 107.2 | 0.155 | 28.8 | 14.7 | 3.1 | 17.8 |
| 64/65 | 480.1 | 7.45 | 108.8 | 0.084 | 28.7 | 20.9 | 2.4 | 23.3 |
| 65/66 | 408.1 | 10.34 | 108.6 | 0.133 | 28.9 | 22.2 | 3.2 | 25.4 |
| 66/67 | 401.4 | 8.66 | 111.6 | 0.149 | 22.6 | 31.3 | 5.0 | 36.3 |
| 67/68 | 460.2 | 5.69 | 110.7 | 0.173 | 20.8 | 25.8 | 7.4 | 33.2 |
| 68/69 | 445.1 | 3.85 | 108.6 | 0.222 | 22.6 | 17.6 | 8.0 | 25.6 |
| 69/70 | 455.0 | 3.58 | 108.7 | 0.345 | 17.8 | 16.6 | 4.8 | 21.4 |
| 70/71 | 468.8 | 2.03 | 106.8 | 0.240 | 24.1 | 13.0 | 4.5 | 17.5 |
| 71/72 | 466.1 | -0.49 | 106.9 | 0.241 | 25.8 | 7.2 | 5.0 | 12.2 |
| 72/73 | 421.6 | 3.59 | 111.0 | 0.223 | 28.5 | 4.3 | 5.8 | 10.1 |
| 73/74 | 451.2 | 5.16 | 112.5 | 0.213 | 21.3 | 16.0 | 6.2 | 22.2 |
| 74/75 | 405.5 | 7.53 | 111.2 | 0.147 | 15.0 | 17.1 | 10.6 | 27.7 |
| 75/76 | 424.3 | 0.66 | 105.4 | 0.314 | 17.8 | 25.5 | 9.5 | 35.0 |
| 76/77 | 429.6 | 0.08 | 106.9 | 0.595 | 19.3 | 17.3 | 4.4 | 21.7 |
| 77/78 | 468.0 | -0.82 | 104.0 | 0.813 | 18.4 | 2.0 | 5.0 | 7.0 |
| 78/79 | 476.5 | -0.32 | 103.4 | 0.704 | 18.5 | 1.3 | 6.1 | 7.4 |
| 79/80 | 410.4 | -0.48 | 104.1 | 0.541 | 15.1 | 1.2 | 10.1 | 11.2 |
| 80/81 | 454.8 | 0.52 | 105.4 | 0.385 | 14.5 | 0.8 | 6.5 | 7.3 |
| 81/82 | 454.8 | 1.58 | 104.8 | 0.242 | 14.6 | 2.6 | 5.1 | 7.7 |
| 82/83 | 437.3 | 4.07 | 106.0 | 0.286 | 18.0 | 2.6 | 2.6 | 5.2 |
| 83/84 | 479.7 | 2.37 | 105.4 | 0.342 | 20.0 | 5.1 | 1.6 | 6.7 |
| 84/85 | 454.0 | -0.35 | 101.6 | 0.365 | 17.7 | 1.4 | 7.9 | 9.3 |
| 85/86 | 478.1 | 0.50 | 103.9 | 0.348 | 20.8 | 0.5 | 6.8 | 7.3 |
| 86/87 | 471.8 | -0.20 | 102.9 | 0.337 | 31.2 | 0.4 | 4.6 | 5.0 |
| 87/88 | 448.5 | 3.80 | 102.0 | 0.327 | 28.8 | 0.3 | 2.3 | 2.6 |
| 88/89 | 494.5 | 1.20 | 101.8 | 0.217 | 24.0 | 2.7 | 3.3 | 6.0 |
| 89/90 | 476.4 | 1.30 | 102.3 | 0.140 | 24.2 | 1.1 | 5.1 | 6.2 |
| 90/91 | 510.1 | -0.10 | 103.1 | 0.093 | 23.5 | 0.4 | 4.1 | 4.5 |
| 91/92 | 469.9 | 1.10 | 105.0 | 0.290 | 23.5 | 0.4 | 4.9 | 5.2 |
| 92/93 | 465.6 | 2.40 | 105.8 | 0.294 | 20.0 | 1.5 | 6.5 | 8.0 |

Source : Government of India, *Economic Survey*, yearly issues.

Note : "Machinery" includes transport-related machinery.

## Table 3 Changes in Planting Systems in Punjab

(%)

| | Rice | Bajra | Maize | Wheat | Gram |
|---|---|---|---|---|---|
| 1960/61 | 4.8 | 2.6 | 6.9 | 29.6 | 17.7 |
| 1992/93 | 27.4 | 0.0 | 2.5 | 43.5 | 0.3 |

Source : Same as Table 1.

## Table 4 Cropping Pattern by District in Haryana

| | Wheat | Gram | Rice | Bajra and millet | Cotton | Maize | Sugarcane | Fodder | Others | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 37.44 | 2.64 | 17.63 | 7.44 | 0.76 | 8.76 | 6.50 | 9.51 | 9.38 | 100.00 |
| Center | 25.93 | 19.95 | 2.96 | 16.40 | 4.38 | 2.48 | 7.69 | 10.94 | 9.27 | 100.00 |
| Southwest | 29.57 | 20.48 | 0.14 | 13.32 | 16.18 | 0.00 | 1.47 | 5.55 | 13.29 | 100.00 |
| Average | 30.89 | 15.08 | 6.27 | 12.37 | 8.54 | 3.20 | 4.58 | 8.13 | 10.94 | 100.00 |
| Punjab | 35.98 | 1.45 | 13.06 | 0.92 | 11.03 | 11.23 | 3.13 | 12.86 | 10.34 | 100.00 |

Rabi crops　　Kharif crops

Note : Irrigated areas only

Source : Calculated from Economic and Statistical Organization, Haryana (India), *Studies of Economics of Farming in Haryana, 1975/76.*
For Punjab, calculated from figures for irrigated areas of 32 sample farms in Economic and Statistical Organization, Punjab (India), *Farm Accounts in Punjab 1975/76.*

## Table 5 Changes in Methods of Irrigation

(%)

| | Punjab | | Haryana | |
|---|---|---|---|---|
| | Canal | Tube-well | Canal | Tube-well |
| 1965/66 | 41.3 | 29.5 | 77.0 | 20.0 |
| 1970/71 | 44.7 | 55.1 | 62.1 | 37.5 |
| 1980/81 | 42.3 | 57.3 | 54.4 | 44.1 |
| 1990/91 | 39.9 | 59.8 | 51.4 | 48.0 |

Note : Ratios of area irrigated by various sources to total irrigated area. Tube-wells include Persian wheels, but the percentage of Persian wheels is negligible. Figures for Haryana are for 1966/67.

Source : Same as Table 1.

## Table 6 Changes in Operationwise Human Labor Input

(Unit : hours/acre)

| Operation | TVs | | | | HYVs | | Use of labor saving technologies | | Name of technology |
|---|---|---|---|---|---|---|---|---|---|
| | TV wheat (1) | Gram (2) | Millet (3) | Bajra (4) | HYV wheat (5) | HYV rice (6) | HYV wheat (7) | HYV rice (8) | (9) |
| Rice nursery | - | - | - | - | - | 8.0 | | | |
| Plowing | 39.6* | 23.6* | 21.0* | 10.0* | 45.0* | 71.0* | → 3.3 | 5.3 | Tractor Seeding Machine |
| Planting | 11.0* | 8.5 | 8.4 | 7.5 | 8.0* | 48.0 | → 0.7 | | |
| Weeding | - | - | - | - | 80.0 | 80.0 | → 1.0 | 1.0 | Weedcide |
| Fertilizing | - | - | - | - | 4.0 | 4.0 | | | |
| Irrigating | 15.0 | 8.5 | 10.4 | 2.4 | 4.0[1] | 20.0[1] | | | |
| Reaping | 43.8 | 39.8 | 30.0 | 23.5 | 40.0 | 40.0 | → | | |
| Threshing | } 43.4* | } 31.7* | }20.7* | }25.0* | } 4.0[2] | 40.0 | → | } 2.0 | H. C |
| Hulling | | | | | | Factory | | | |
| Others | 3.6 | 6.7 | 1.6 | 9.4 | - | - | | | |
| Total | 155.2 | 118.8 | 92.1 | 77.8 | 186.0 | 309.0 | 57.0 | 166.3 | |

Source : For columns (1) to (4), Punjab (India), The Economic and Statistical Organization, *The Studies in the Economics of Farm Management in the Punjab; Karnal, Rohtak & Jind, Report 1961/62*. Figures are only for irrigated areas.
For remaining columns, based on the survey in village N (1981-82).

Notes: 1) Use of TW. This is done by family labor.
2) Done with thresher. In village N all threshing is done with threshers, so figures for column (7) are not included.
* Operations involving bullock labor.

## Table 7 Operationwise Use of Tractors among Tractor Users

(Unit : hours/year)

| | Hours | % |
|---|---|---|
| Plowing | 136 | 43 |
| Sowing | 25 | 8 |
| Threshing | 60 | 19 |
| Transporting | 85 | 27 |
| Others | 10 | 3 |
| Total | 316 | 100 |

Source : India, National Council of Applied Economic Research, *Implications of Tractorization for Farm Employment, Productivity and Income*, Vol. 2, New Delhi, 1980.

## Table 8 Operationwise Family and Hired Labor Input

(Unit : days/ha)

| | Bullock farm | | Tractor owner | |
|---|---|---|---|---|
| | Family labor | Hired labor | Family labor | Hired labor |
| Plowing | 9.5 | 2.0 | 1.4 | 0.3 |
| Sowing | 5.1 | 1.7 | 2.1 | 2.1 |
| Fertilizer Application | 1.1 | 0.2 | 0.7 | 0.4 |
| Irrigating | 4.7 | 1.6 | 4.0 | 2.7 |
| Pestiticide use | - | 0.1 | 0.4 | 0.3 |
| Interculture | 1.9 | 4.7 | 1.0 | 4.5 |
| Harvesting | 12.1 | 11.5 | 9.9 | 14.5 |
| Threshing | 4.5 | 1.6 | 2.7 | 2.8 |
| Transportion | 4.0 | 0.5 | 5.9 | 0.9 |
| Total | 42.9 | 23.9 | 28.1 | 28.5 |

Source : India, National Council of Applied Economic Research, *Implications of Tractorization for Farm Employment, Productivity and Income*, Vol. 2, New Delhi, 1980.

## Table 9 Land Leased in by Tractor Farms and Bullock Farms (Hisar District, Haryana)

(Unit : ha)

| Area owned | Tractor farms | | Bullock farms | |
|---|---|---|---|---|
| | Owned land | Leased in land | Owned land | Leased in land |
| 2 ha or less | 1.62 | - | 1.03 | 0.01 |
| 2 ~ 4 | 3.11 | 0.28 | 2.83 | - |
| 4 ~ 10 | 6.84 | 0.17 | 5.16 | - |
| 10 ha or larger | 14.87 | 1.85 | 11.74 | - |

Source : India, National Council of Applied Economic Research, *Implications of Tractorization for Farm Employment, Productivity and Income*, Vol. 2, New Delhi, 1980.

## Table 10 Socioeconomic Indices of Surveyed Regions

| State | Per capita net domestic product 1988-89 | Percentage use of family planning 1989 | Literacy rate 1981 | Expectation of life (females) 1986-91 | Expectation of life (males) 1986-91 |
|---|---|---|---|---|---|
| Punjab | 6227 | 69.6 | 33.67 | 62.69 | 62.84 |
| Haryana | 5274 | 59.4 | 26.89 | 57.21 | 59.89 |

Source : Compiled from Department of Family Welfare, Yearbook 1990-91 (Family Welfare Program in India) and others.

## Table 11 Demographic Indices for Punjab and Haryana

| State | Year | Crude birth rate | Crude death rate | Natural growth rate | Infant mortality rate | Total population |
|---|---|---|---|---|---|---|
| Punjab | 1981 | 30.3 | 9.4 | 20.9 | 81 | 16,789 |
| | 1982 | 30.4 | 8.4 | 22.2 | 75 | |
| | 1983 | 30.2 | 9.5 | 20.7 | 80 | |
| | 1984 | 30.3 | 9.0 | 21.3 | 66 | |
| | 1985 | 28.5 | 8.9 | 19.6 | 71 | |
| | 1986 | 28.7 | 8.2 | 20.5 | 68 | |
| | 1987 | 28.7 | 8.1 | 20.6 | 62 | |
| | 1988 | 28.5 | 8.4 | 20.1 | 62 | |
| | 1989 | 28.3 | 8.2 | 20.2 | 64 | |
| | 1990 | 27.6 | 7.8 | 19.9 | 61 | |
| | 1991 | 27.7 | 7.8 | 19.9 | 53 | 20,191 |
| | 1992 | 27.1 | 8.2 | 18.9 | 56 | |
| Haryana | 1981 | 36.5 | 11.3 | 25.2 | 101 | 12,923 |
| | 1982 | 36.7 | 9.2 | 27.5 | 93 | |
| | 1983 | 35.9 | 9.0 | 26.9 | 91 | |
| | 1984 | 37.2 | 10.9 | 26.3 | 101 | |
| | 1985 | 35.7 | 9.1 | 26.6 | 85 | |
| | 1986 | 35.3 | 8.7 | 26.6 | 85 | |
| | 1987 | 34.5 | 8.8 | 25.7 | 87 | |
| | 1988 | 33.8 | 9.8 | 24.0 | 90 | |
| | 1989 | 35.2 | 8.5 | 26.6 | 82 | |
| | 1990 | 31.9 | 8.4 | 23.5 | 69 | |
| | 1991 | 33.1 | 8.2 | 24.9 | 68 | 16,318 |
| | 1992 | 32.0 | 8.7 | 23.3 | 75 | |

Source : Simple Registration Bulletin, Vol. XXVII, No. 2, 1994.

## Table 12 Demographic Indices by Urban and Rural Area

| State | Population distribution (%) 1991 | Birth rate (‰) 1990 | Death rate (‰) 1990 | Natural growth rate (‰) 1990 |
|---|---|---|---|---|
| Punjab | | | | |
| Urban areas | 29.7 | 25.6 | 5.8 | 19.8 |
| Rural areas | 70.3 | 28.4 | 8.5 | 19.9 |
| Haryana | | | | |
| Urban areas | 24.8 | 27.5 | 6.9 | 20.6 |
| Rural areas | 75.2 | 33.0 | 8.9 | 24.1 |

Source : Compiled from Department of Family Welfare, Yearbook 1990-91 (Family Welfare Program in India) and others.

## Table 13 Trends in Harvested Areas of Major Crops

(Unit : 1000 ha)

| Crop \ Year | 1984/85 | 85/86 | 86/87 | 87/88 | 88/89 | 89/90 | 90/91 | 91/92 | 92/93 |
|---|---|---|---|---|---|---|---|---|---|
| Rice | 5,173 | 5,335 | 5,366 | 5,101 | 5,308 | 5,286 | 5,390 | 4,813 | 4,619 |
| Wheat | 1,873 | 1,835 | 1,840 | 2,116 | 2,112 | 1,988 | 1,965 | 1,963 | 2,170 |
| Maize | 682 | 669 | 649 | 659 | 693 | 703 | 665 | 668 | 894 |
| Total food grains | 8,074 | 8,172 | 8,162 | 8,148 | 8,368 | 8,222 | 8,238 | 7,659 | 7,903 |
| Beans | 1,201 | 1,239 | 1,253 | 1,184 | 1,137 | 1,209 | 1,170 | 1,098 | 1,410 |
| Cash crops (sugarcane, potatoes, jute, etc.) | 989 | 869 | 784 | 774 | N. A. | 527 | 517 | N. A. | N. A. |
| Oilseeds | 245 | 238 | 233 | 221 | 211 | 204 | 241 | 225 | 463 |
| Total harvested area | 10,309 | 10,518 | 10,432 | 10,327 | N. A. | 10,162 | 10,184 | N. A. | N. A. |

Source : *Bihar at a Glance* (yearly issues) and Bihar government materials. Directorate of Statistics & Evaluation, Bihar, Patna.

## Table 14 Irrigated Area Rate: 1990/91

(%)

| State | Rice | Wheat | Total crops |
|---|---|---|---|
| Bihar | 35.4 | 85.5 | 40.0 |
| Punjab | 99.2 | 96.1 | 94.0 |
| Haryana | 99.1 | 97.6 | 71.6 |
| Total India | 45.1 | 80.1 | 33.3 |

Source : *Agricultural Statistics at a Glance*, March 1994. Directorate of Economics & Statistics, Department of Agric. & Cooperation, Ministry of Agriculture, Gov. of India.

## Table 15 Per Capita Electric Power Consumption by State: 1991/92

(in 1000 kWh)

| State | Total consumption (millions of kWh) | Population (thousands) | Per capita consumption |
|---|---|---|---|
| Bihar | 7,569 | 86,339 | 87.7 |
| Punjab | 12,522 | 20,191 | 620.2 |
| Haryana | 7,139 | 16,318 | 437.5 |
| Total India | 207,645 | 843,931 | 246.0 |

Source : For total consumption, same as Table 14. For population, North, "1991 Population Census: Some Facts and Policy Issues", *Economic and Political Weekly*, Sept. 14 1991, p. 2149.

## Table 16 Fertilizer Input by State: 1992/93

(kg/ha)

| State | Nitrogen | Phosphoric acid | Potassium | Total |
|---|---|---|---|---|
| Bihar | 45.55 | 9.62 | 2.01 | 57.18 |
| Punjab | 126.41 | 34.39 | 1.43 | 162.23 |
| Haryana | 82.24 | 25.10 | 0.44 | 107.79 |
| Total India | 46.58 | 15.69 | 4.88 | 67.09 |

Source : Same as Table 14.

## Table 17 Mechanization of Agriculture by State: Units per 1000 Male Agricultural Workers

| State | 1962 to 1965 | | 1980 to 1983 | | 1970 to 1993 | |
|---|---|---|---|---|---|---|
| | Tractors | Pumps | Tractors | Pumps | Tractors | Pumps |
| Bihar | 0.21 | 1.04 | 0.60 | 7.73 | 0.78 | 16.84 |
| Punjab | 5.50 | 23.70 | 16.22 | 132.35 | 23.80 | 161.40 |
| Haryana | 3.32 | 10.86 | 12.32 | 68.08 | 15.17 | 95.70 |

Source : Bhalla, G.S. and D.S. Tyagi : *Patterns in Indian Agricultural Development – A District Level Study*, Institute for Studies in Industrial Development, New Delhi, 1989, Appendix 4.

## Table 18 Systematic Financing for Agriculture by State: 1991/92

(Unit: Rs. in Cers)

| State | Short-term | Mid-term | Long-term | Total |
|---|---|---|---|---|
| Bihar | 83.55 | 50.00 | 8.69 | 142.22 |
| Punjab | 634.89 | - | 78.39 | 713.28 |
| Haryana | 729.93 | 2.85 | 74.00 | 806.78 |
| Total India | 5,137.9 | 182.17 | 1,213.35 | 6,533.42 |

Source : Same as Table 14.

## Table 19 Trends in HYV Diffusion Rate in Bihar (% in total harvested area)

| Crop \ Year | 1975/76 | 80/81 | 84/85 | 85/86 | 86/87 | 87/88 | 88/89 | 89/90 | 90/91 |
|---|---|---|---|---|---|---|---|---|---|
| Rice | 14.6 | 25.5 | 28.1 | 29.8 | 30.7 | 31.9 | 28.4 | 30.6 | 30.9 |
| Wheat | 67.7 | 99.8 | 71.6 | 70.4 | 71.5 | 63.7 | 71.0 | 74.0 | 74.5 |

Source : Same as Table 13.

## Table 20 Distribution by Size of Land Worked (1985/86)

| Size \ State | Bihar | | Haryana | | Punjab | | Total India | |
|---|---|---|---|---|---|---|---|---|
| | Number farms (1000) | Area (1000ha) | Number farms (1000) | Area (1000ha) | Number farms (1000) | Area (1000ha) | Number farms (1000) | Area (1000ha) |
| Less than 1 ha | 8,976 | 3,303 | 502 | 229 | 256 | 139 | 56,147 | 22,042 |
| | (76.6) | (30.3) | (37.3) | (6.2) | (23.5) | (3.4) | (57.8) | (13.4) |
| 1 ~ 2 ha | 1,327 | 1,869 | 265 | 383 | 208 | 311 | 17,922 | 25,708 |
| | (11.3) | (17.1) | (19.7) | (10.3) | (19.1) | (7.6) | (18.4) | (15.6) |
| 2 ~ 4 ha | 951 | 2,593 | 281 | 790 | 291 | 840 | 13,252 | 36,666 |
| | (8.1) | (23.8) | (20.9) | (21.3) | (26.7) | (20.5) | (13.6) | (22.3) |
| 4 ~ 10 ha | 404 | 2,293 | 239 | 1,409 | 260 | 1,589 | 7,916 | 47,144 |
| | (3.4) | (21.0) | (17.7) | (37.9) | (23.9) | (38.7) | (8.1) | (28.6) |
| Greater than 10 ha | 52 | 839 | 60 | 902 | 74 | 1,225 | 1,918 | 33,002 |
| | (0.4) | (7.7) | (4.5) | (29.3) | (6.8) | (29.8) | (2.0) | (20.1) |
| Total | 11,711 | 10,898 | 1,347 | 3,714 | 1,030 | 4,104 | 97,155 | 164,562 |
| | (100) | (100) | (100) | (100) | (100) | (100) | (100) | (100) |
| Average (ha) | 0.93 | | 2.76 | | 3.77 | | 1.69 | |

Note : Figures in parentheses are percentages.
Source : *All-India Report on Agricultural Census, 1985-86*, Dept. of Agric. and Cooperation, Ministry of Agriculture, Gov. of India, New Delhi, 1992.

## Table 21 Fragmentation of Plots in Bihar

| Size of land worked (ha) | Average years | Area per parce (ha) |
|---|---|---|
| Less than 1.0 ha | 3.4 | 0.10 |
| 1.0 - 2.0 | 6.7 | 0.19 |
| 2.0 - 4.0 | 9.1 | 0.24 |
| 4.0 - 10.0 | 12.5 | 0.45 |
| Greater than 10.0 | 17.6 | 0.98 |
| Average | 4.9 | 0.22 |

Source : Agricultural Census of Bihar 1076-77, Input Survey, Part II.

## Table 22 Situation of Tenant Farming in Bihar

(%)

| Class category | Sample household ratio | Sample farming household ratio | Farming situation (household ratio) | | | Owned land and leased land within farmed land (land area ratio) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Does not farm | Farms 2 acres or less | Has leased land | Owned land | Leased land | Breakdown of lease conditions | | |
| | | | | | | | | Sharing of harvest | Land leased for labor | Other |
| Temporary agricultural worker | 30.5 | 11.0 | 43.9 | 45.6 | 41.3 | 38.9 | 61.1 | 46.5 | 4.0 | 10.6 |
| Regular agricultural worker | 14.5 | 6.1 | 36.6 | 53.6 | 66.8 | 32.6 | 67.4 | 44.5 | 13.7 | 9.2 |
| Poor medium-scale farmer | 7.1 | 4.3 | 0.0 | 77.5 | 47.4 | 41.6 | 58.4 | 47.2 | 0.0 | 11.2 |
| Medium-scale farmer | 7.5 | 9.3 | 0.0 | 50.0 | 76.0 | 47.9 | 52.1 | 34.8 | 0.0 | 17.3 |
| Large-scale farmer | 19.2 | 41.3 | 1.9 | 20.5 | 34.0 | 86.1 | 13.9 | 8.6 | 0.0 | 5.3 |
| Landowner | 14.4 | 27.9 | 21.1 | 23.3 | 5.4 | 98.6 | 1.4 | 1.4 | 0.0 | 0.0 |
| Non-agricultural | 6.9 | 0.2 | 94.9 | 8.1 | 4.2 | 16.7 | 83.3 | 83.3 | 0.0 | 0.0 |
| Total | 100.1 | 100.1 | 28.3 | 38.9 | 38.9 | 58.8 | 41.2 | 32.4 | 4.4 | 5.4 |

Source : Fumiko Oshikawa, "Indo ni okeru 'hinkon' mondai e no apurochi wo megutte – ANSISS-ILO chosa wo te-gakari ni" (Concerning Approaches to the Problem of 'Poverty' in India, with an ANSISS-ILO Survey as a Clue), "Asia Keizai" (Asian Economy), Vo. 32, No. 3, 1991, pp. 90-105.

Original source : Prasad, P.H. et al., "The Dynamics of Employment and Poverty in Bihar", Patna, A.N. Sinha Institute of Social Studies and International Labor Organization, 1989.

## Table 23 Irrigated Area by Water Source: Bihar

(Unit: 1000 ha)

| Year | Water-channel | Reservoir | Tube-well | Well | Other | Total |
|---|---|---|---|---|---|---|
| 1970/71 | 1,106 | 178 | 510 | 219 | 688 | 2,701 |
| | (40.9) | (6.6) | (18.9) | (8.1) | (25.5) | (100) |
| 1980/81 | 1,421 | 116 | 989 | 240 | 863 | 3,590 |
| | (39.6) | (3.2) | (27.6) | (6.7) | (24.0) | (100) |
| 1990/91 | 1,411 | 139 | 1,754 | 153 | 733 | 4,192 |
| | (33.7) | (3.3) | (41.8) | (3.7) | (17.5) | (100) |

Note : Figures in parentheses are percentages.

Source : Same as Table 13.

## Table 24 Use of Ground Water Resources in Bihar: 1982/83

(Unit: 100,000 ha·m/year)

| | Use | % | Potential ground water resources |
|---|---|---|---|
| Total India | 99.98 | 23.73 | 422.86 |
| Bihar | 4.513 | 13.75 | 33.025 |
| North | 2.224 | 16.29 | 13.651 |
| South | 2.029 | 15.27 | 13.357 |
| Chota Nagpur and Santhal Pargana | 0.2786 | 4.96 | 6.017 |

Source : Sharma, I., "Underdevelopment Outside the 'Vicious Circle': Case of Shallow Tube Wells", A.N. Sharma and S. Gupta (eds.), Bihar, Patna: Delhi; Spectrum Publishing House, 1987, p. 206.

## Table 25 Area Irrigated by Tube-Wells in Bihar

| Year | No. tube-wells (1000) | | Irrigated area (1000 ha) | | Average irrigated area per tube-well (ha) | |
|---|---|---|---|---|---|---|
| | National | Private | National | Private | National | Private |
| 1973/74 | 2,677 | 73,000 | 129,582 | 596,848 | 48.41 | 8.18 |
| 1975/76 | 3,014 | 106,500 | 175,508 | 658,972 | 58.23 | 6.19 |
| 1977/78 | 3,744 | 140,000 | 139,630 | 1,044,362 | 37.29 | 7.46 |
| 1980/81 | 4,606 | 216,000 | 77,487 | 923,513 | 16.82 | 4.28 |
| 1983/84 | 4,930 | 345,500 | 49,700 | 1,168,300 | 10.08 | 3.38 |

Source : Same as Table 24, p. 207.

## Table 26 Irrigation Costs by Water Source in Bihar

(Rs/ha)

| Water channels | National tube-wells | | Private tube-wells | |
|---|---|---|---|---|
| | 10% efficiency | 40% efficiency | Diesel | Electric |
| 3,289 | 15,001 | 4,746 | 2,139 | 1,406 |

Source : Sharma, I.D. and M.P. Sinha, "Action Report on Conjunctive Irrigation in the Lower Gandak Command", Center for Water Resources Studies, Patna University, 1994 August.

## Table 27 International Competitiveness of Major Fruits and Vegetables

| Crop | NPC (Nominal Protection Coefficient) | |
|---|---|---|
| Mango | 0.81 | (average for 1989/90 to 92/93) |
| Litchi | 0.55 | (1993) |
| Onion | 0.71 | (average for 1986/87 to 92/93) |
| Potato | 0.97 | (average for 1986/87 to 92/93) |
| Tomato | 0.58 | (average for 1988/89 to 92/93) |

Note : $NPC = \frac{\text{Domestic wholesale price}}{\text{(F.O.B. price x 1.2) - (export expenses)}}$

Source : Gulati, A., et al., *Export Competitiveness of Selected Agricultural Commodities*, NCAER, 1994.

## Table 28 Socioeconomic Indices of Surveyed Regions

| State | Per capita net domestic product 1988-89 | Percentage use of family planning 1989 | Literacy rate 1981 | Expectation of life (females) 1986-91 | Expectation of life (males) 1986-91 |
|---|---|---|---|---|---|
| Bihar | 2266 | 25.8 | 19.94 | 53.71 | 50.71 |

Source : Compiled from Department of Family Welfare, Yearbook 1990-91 (Family Welfare Program in India) and others.

## Table 29 Demographic Indices for Bihar

| Year | Crude birth rate | Crude death rate | Natural growth rate | Infant mortality rate | Total population |
|---|---|---|---|---|---|
| 1981 | 39.1 | 13.9 | 25.2 | 118 | 69.915 |
| 1982 | 37.3 | 14.1 | 23.2 | 112 | |
| 1983 | 37.2 | 13.0 | 24.2 | 99 | |
| 1984 | 39.9 | 14.5 | 25.4 | 95 | |
| 1985 | 37.8 | 15.0 | 22.8 | 106 | |
| 1986 | 36.5 | 13.8 | 22.7 | 101 | |
| 1987 | 36.6 | 13.1 | 23.5 | 101 | |
| 1988 | 37.3 | 12.6 | 24.7 | 97 | |
| 1989 | 34.3 | 12.1 | 22.3 | 91 | |
| 1990 | 32.9 | 10.6 | 22.4 | 75 | |
| 1991 | 30.7 | 9.8 | 20.9 | 69 | 86,339 |
| 1992 | 32.3 | 10.9 | 21.4 | 73 | |

Source : Simple Registration Bulletin, Vol. XXVII, No. 2, 1994.

## Table 30 Demographic Indices by Urban and Rural Area

| State | Population distribution (%) 1991 | Birth rate (‰) 1990 | Death rate (‰) 1990 | Natural growth rate (‰) 1990 |
|---|---|---|---|---|
| Bihar | | | | |
| Urban areas | 13.2 | 24.6 | 6.2 | 18.4 |
| Rural areas | 86.8 | 33.8 | 11.0 | 22.8 |

Source : Compiled from Department of Family Welfare, Yearbook 1990-91 (Family Welfare Program in India) and others.

## Table 31 Cropping System in the Ganges Plains

| | Percentage of total cropped area (%) | | | Land productivity (Kg/ha) | | |
|---|---|---|---|---|---|---|
| | Rice | Wheat | Maize | Rice | Wheat | Maize |
| Punjab | 24.00 | 43.70 | 3.27 | 3330 | 3500 | 2020 |
| Haryana | 8.25 | 30.91 | 0.70 | 2460 | 2840 | 1240 |
| Uttar Pradesh | 18.35 | 33.40 | 4.58 | 1360 | 1930 | 1220 |
| Bihar | 48.29 | 18.40 | 6.18 | 1120 | 1050 | 1380 |
| West Bengal | 68.56 | 4.68 | 0.69 | 1570 | 1720 | 3080 |

Source : Central Statistics Organization, Department of Statistics, Government of India, *Statistical Abstract*, 1989.

## Table 32 Basic Data on Ganges Plains States

| | Area (1,000km²) (1987) | Population (1,000) (1991) | Per capita income Rs (1989/90) |
|---|---|---|---|
| Punjab | 50 | 20,191 | 7674 |
| Haryana | 44 | 16,318 | 6210 |
| Uttar Pradesh | 294 | 138,760 | 3061 |
| Bihar | 174 | 86,339 | 2330 |
| West Bengal | 89 | 67,983 | 4236 |

Source : Registrar General and Census Commissioner, Government of India, *Census of India 1991, Series-1, India, Paper I of 1991, Provisional Population Totals*, New Delhi, March 1991, and Ministry of Finance, Government of India, *Economic Survey 1993-94*.

## Table 33 Interstate Movement of Foodgrains

(1988, '000 tonnes)

| | Paddy | | | Wheat | | |
|---|---|---|---|---|---|---|
| | Export | Import | Net export | Export | Import | Net export |
| **Ganges plains** | | | | | | |
| Punjab | 2723 | 7 | 2716 | 4013 | 3 | 4010 |
| Haryana | 549 | 2 | 547 | 159 | 3 | 156 |
| Uttar Pradesh | 605 | 20 | 585 | 2035 | 138 | 1897 |
| Bihar | 8 | 122 | -114 | 40 | 738 | -698 |
| West Bengal | 30 | 562 | -532 | 43 | 528 | -485 |
| Delhi | 69 | 77 | -8 | 3 | 562 | -559 |
| Himachal Pradesh | - | - | - | - | - | - |
| Jammu & Kashmir | 6 | 44 | -38 | - | 75 | -75 |
| Assam | 63 | 549 | -486 | 151 | 277 | -126 |
| Andhra Pradesh | 1269 | 174 | 1195 | 173 | 444 | -271 |
| Orissa | 33 | 28 | 5 | 2 | 276 | -274 |
| Rajasthan | 52 | 6 | 46 | 75 | 312 | -238 |
| Gujarat | 4 | 75 | -71 | 59 | 197 | -138 |
| Madhya Pradesh | 256 | 124 | 132 | 343 | 325 | 18 |
| Maharashtra | 101 | 394 | -293 | 454 | 757 | -303 |
| Karnataka | 40 | 421 | 381 | - | 425 | -425 |
| Kerala | 194 | 1391 | -1187 | 21 | 133 | -112 |
| Tamil Nadu | 46 | 484 | -438 | 62 | 437 | -375 |

Note : Haryana had a poor crop in 1988. The figures of exports of rice and wheat for the previous year were 974 and 1228, respectively.

Source : Government of India, Department of Statistics, *Statistical Abstract, 1989.*

## Table 34 Percentage of Population Below the Poverty Line

(%)

| | 1972/73 | 1977/78 | 1983 | 1987/88 |
|---|---|---|---|---|
| **Ganges plains** | | | | |
| Punjab | 13.89 | 10.24 | 8.48 | 6.99 |
| Haryana | 13.89 | 19.20 | 11.74 | 11.43 |
| Uttar Pradesh | 36.83 | 36.07 | 32.60 | 29.43 |
| Bihar | 52.24 | 52.22 | 50.54 | 40.40 |
| West Bengal | 60.96 | 58.59 | 48.64 | 34.67 |
| Himachal Pradesh | 11.75 | 22.72 | 11.06 | 9.56 |
| Jammu & Kashmir | 17.78 | 24.38 | 10.50 | 13.28 |
| Assam | 34.73 | 38.81 | 21.63 | 23.79 |
| Andhra Pradesh | 40.77 | 29.15 | 18.74 | 13.38 |
| Orissa | 66.92 | 62.54 | 50.29 | 46.22 |
| Rajasthan | 34.56 | 25.99 | 24.67 | 21.38 |
| Gujarat | 40.12 | 31.52 | 14.92 | 15.28 |
| Madhya Pradesh | 53.25 | 53.08 | 37.15 | 28.81 |
| Maharashtra | 56.74 | 54.27 | 34.28 | 31.23 |
| Karnataka | 34.27 | 38.37 | 27.81 | 23.47 |
| Kerala | 51.73 | 41.47 | 27.05 | 19.29 |
| Tamil Nadu | 45.97 | 48.34 | 40.79 | 36.00 |
| **Average** | 42.93 | 40.21 | 31.40 | 24.68 |

Source : Department of Statistics, Ministry of Planning, Government of India, *Sarvekshana*, Vol. 2 No. 3, 1979; Vol. 9 No. 3, 1986; Vol. 15 No. 1, 1991.

## Table 35 Percentage of Population Below the Poverty Line by Rural Class

1993, %

| | Landowners | Agricultural workers | Rural workers |
|---|---|---|---|
| **Ganges plains** | | | |
| Punjab | 3.27 | 18.73 | 17.37 |
| Haryana | 8.72 | 24.53 | 24.07 |
| Uttar Pradesh | 32.64 | 51.83 | 48.22 |
| Bihar | 42.43 | 73.85 | 72.84 |
| West Bengal | 35.82 | 74.50 | 71.15 |
| Himachal Pradesh | 13.99 | 14.44 | 17.37 |
| Jammu & Kashmir | 11.72 | 22.44 | 22.06 |
| Assam | 24.49 | 38.62 | 40.84 |
| Andhra Pradesh | 16.69 | 28.74 | 27.33 |
| Orissa | 51.14 | 68.30 | 67.68 |
| Rajasthan | 30.04 | 36.47 | 32.03 |
| Gujarat | 21.63 | 27.16 | 28.38 |
| Madhya Pradesh | 37.34 | 54.85 | 53.79 |
| Maharashtra | 32.12 | 52.40 | 48.94 |
| Karnataka | 24.44 | 41.59 | 39.05 |
| Kerala | 23.99 | 41.40 | 38.70 |
| Tamil Nadu | 34.82 | 56.78 | 53.66 |
| **Average** | 30.43 | 49.36 | 46.44 |

Source : Department of Statistics, Ministry of Planning, Government of India, *Sarvekshana*, Vol. 13 No. 1, 1989.

## Table 36 Comparison of Rice Production Costs

(Rs/ha)

| | Punjab (1989/90) | Haryana (1989/90) | Bihar (1987/88) |
|---|---|---|---|
| A Human Labor | | | |
| Hired labor | 990.15 | 1042.98 | 511.87 |
| Family labor | 492.06 | 715.91 | 657.50 |
| Total | 1482.21 | 1758.89 | 1169.37 |
| B Bullock Labor | | | |
| Hired | 2.16 | 0.04 | 28.46 |
| Owned | 200.55 | 168.19 | 519.61 |
| Total | 202.71 | 168.23 | 548.07 |
| C Farm machinery | | | |
| Hired | 355.36 | 177.21 | 10.14 |
| Owned | 416.76 | 261.52 | 3.27 |
| Total | 772.12 | 438.75 | 13.41 |
| D Seed | 155.64 | 152.98 | 146.70 |
| E Fertilizer | | | |
| Chemical fertilizer | 894.24 | 626.86 | 242.34 |
| Manure | 95.55 | 37.66 | 67.15 |
| Total | 989.79 | 664.52 | 309.49 |
| F Insecticide | 220.13 | 192.16 | 0.00 |
| G Irrigation charges | 755.44 | 1121.25 | 42.68 |
| H Others | 126.03 | 118.15 | 49.15 |
| Total | 4704.07 | 4614.91 | 2278.87 |

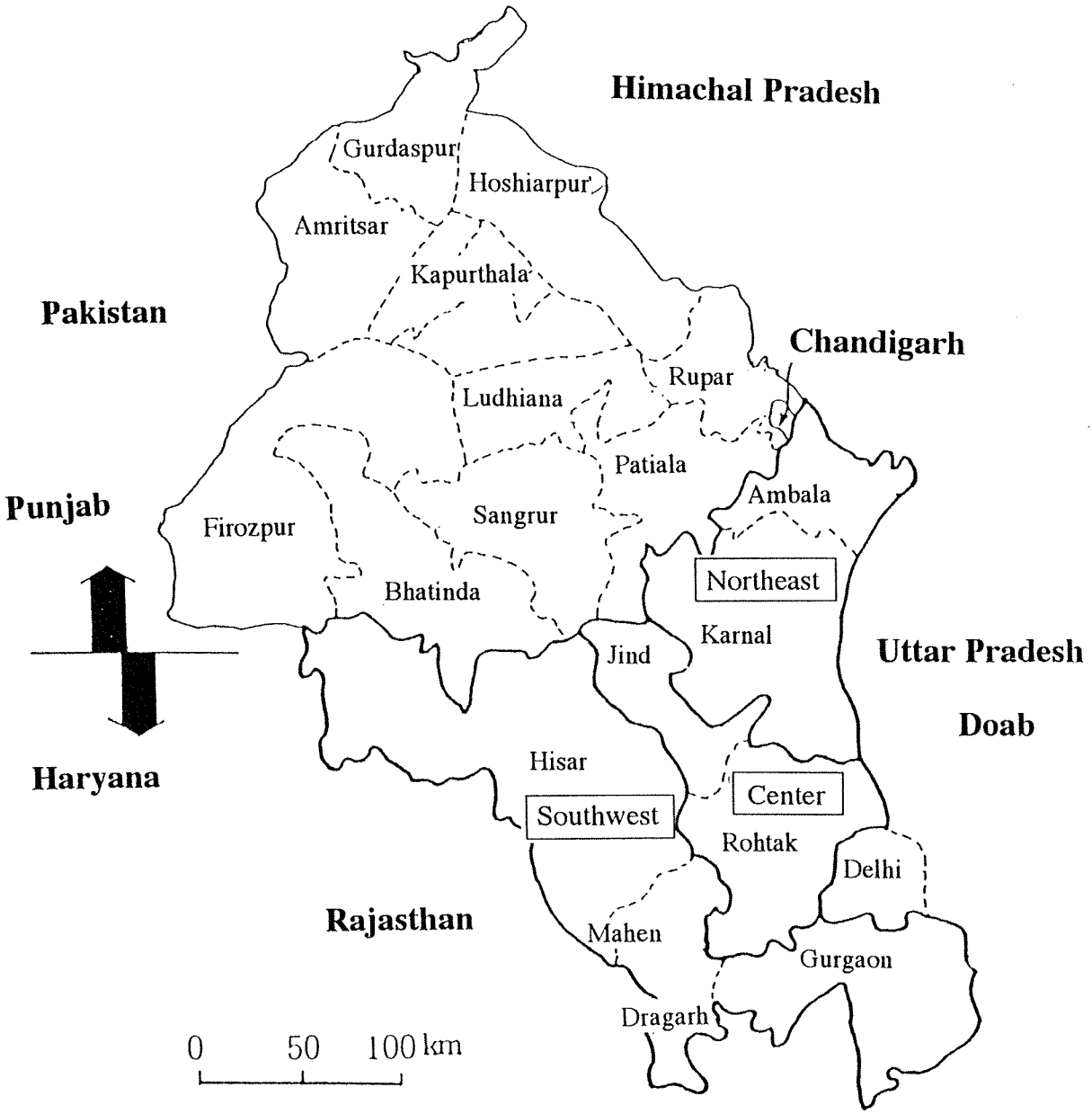
Source : Ministry of Agriculture, Government of India, *Reports of the Commission for Agricultural Costs and Prices on Price Policy for Crops Sown in 1991-92 Season and 1992-93 Season*, New Delhi, 1993.

## Table 37 Agriculture Statistics

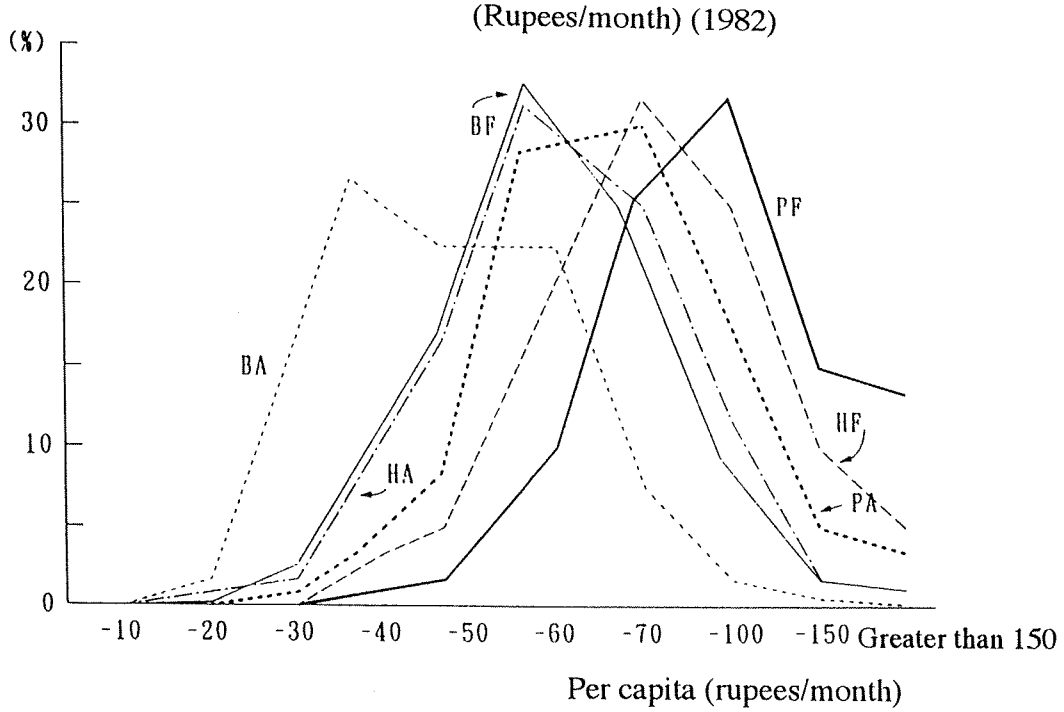
| | Average area worked (ha) | Irrigation rate (1989/90) | Chemical fertilizer consumption (kg/ha) | Rural electrification rate (1986) |
|---|---|---|---|---|
| **Ganges plains** | | | | |
| Punjab | 3.77 | 93.4 | 158.6 | 100.0 |
| Haryana | 2.76 | 74.0 | 94.4 | 100.0 |
| Uttar Pradesh | 0.92 | 60.0 | 83.0 | 60.0 |
| Bihar | 0.86 | 40.4 | 54.1 | 52.6 |
| West Bengal | 0.92 | 35.8 | 81.7 | 53.9 |
| Himachal Pradesh | 1.30 | 17.0 | Na | 90.5 |
| Jammu & Kashmir | 0.86 | 42.5 | Na | 89.1 |
| Assam | 1.31 | 21.1 | 6.1 | 62.1 |
| Andhra Pradesh | 1.72 | 38.6 | 131.1 | 87.0 |
| Orissa | 1.47 | 30.7 | 19.8 | 53.0 |
| Rajasthan | 4.34 | 23.3 | 17.7 | 62.7 |
| Gujarat | 3.15 | 34.5 | 62.3 | 92.8 |
| Madhya Pradesh | 2.91 | 18.9 | 30.3 | 61.9 |
| Maharashtra | 2.65 | 11.3 | 59.5 | 94.4 |
| Karnataka | 2.41 | 19.6 | 66.0 | 92.0 |
| Kerala | 0.36 | 14.8 | 74.5 | 100.0 |
| Tamil Nadu | 1.01 | 44.1 | 119.7 | 99.9 |
| **Average** | 1.68 | 33.1 | 65.4 | 67.7 |

Source : Same as Table 31.

**Figure 1 Northwestern India**



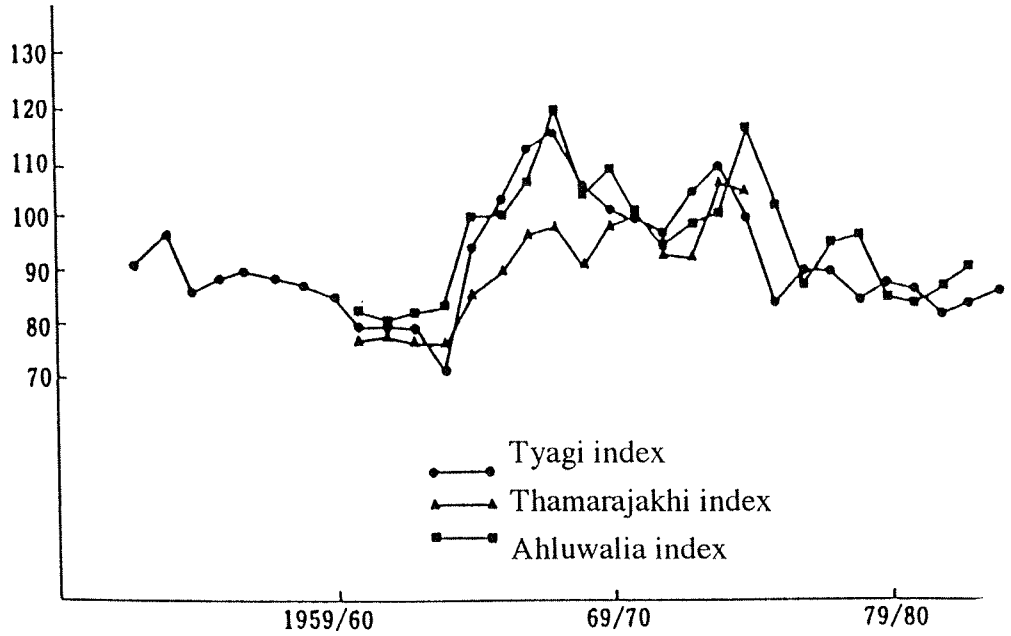
## Figure 2 Distribution of Per Capita Rural Family Expenses




Note : P – Punjab, H – Haryana, B – Bihar
F – Land-owning farmers, A – Agricultural workers

Source : Calculated from Department of Statistics, Ministry of Planning, Government of India, *Sarvekshana*, Vol. IV, Nos. 1 - 2, July-October 1982.

**Figure 3 Trends in Terms of Trade Indices Between Agriculture and Industry** (1970/71=100)



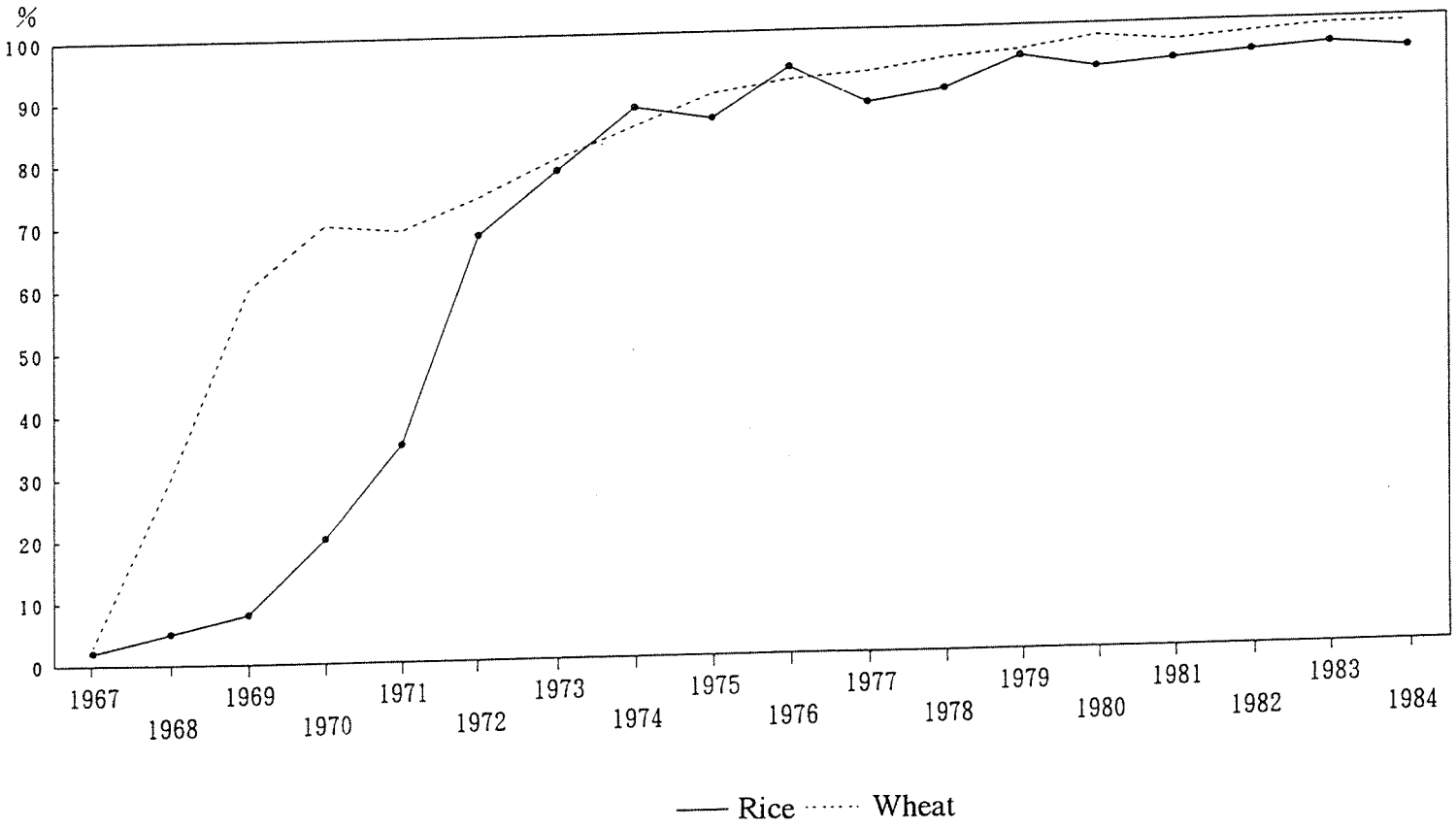

Note:

Tyagi index : Ratio of agricultural commodity sales prices to non-agricultural sector product purchase prices for farmers.

Thamarajakhi index : Ratio of wholesale prices of agricultural commodities to wholesale prices of non-agricultural commodities.

Ahluwalia index : Ratio of prices of grain (wage asset) to prices of industrial commodities.

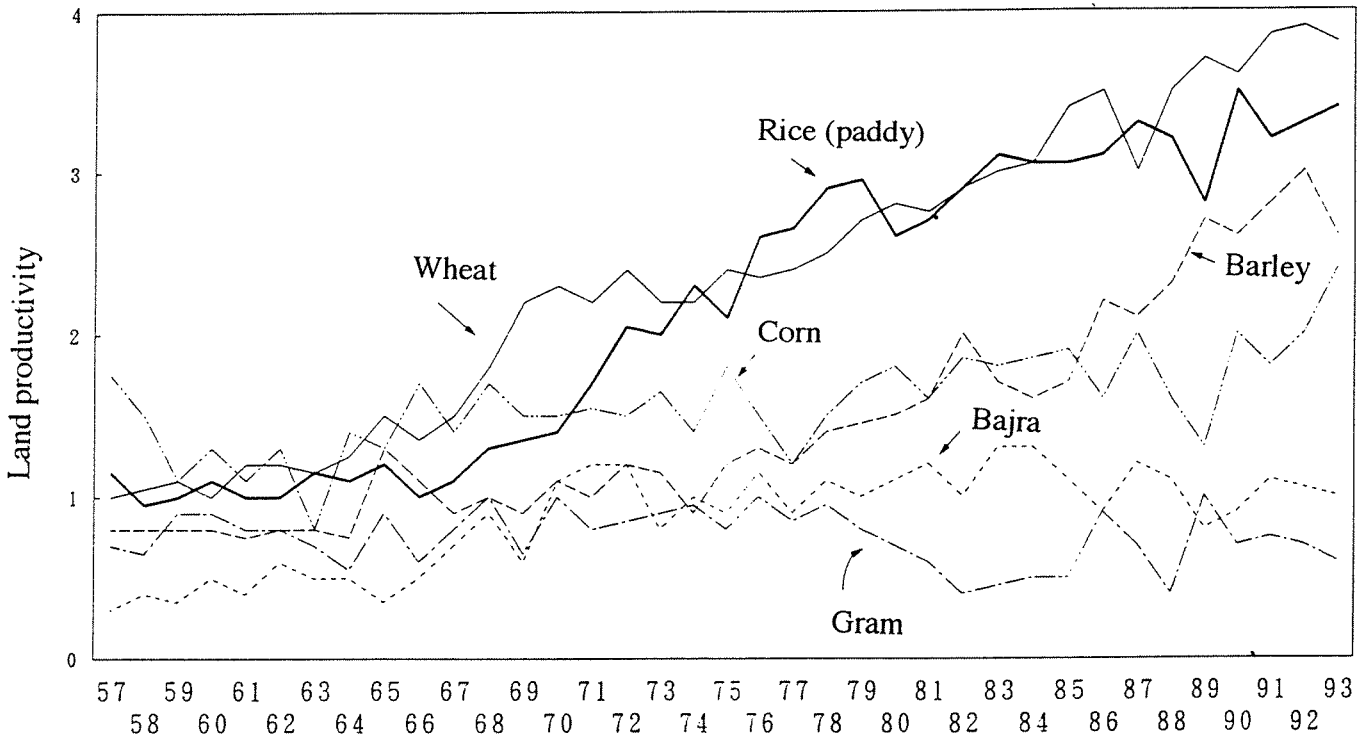
## Figure 4 Rate of Transition to HYVs




Source : Same as Table 1.

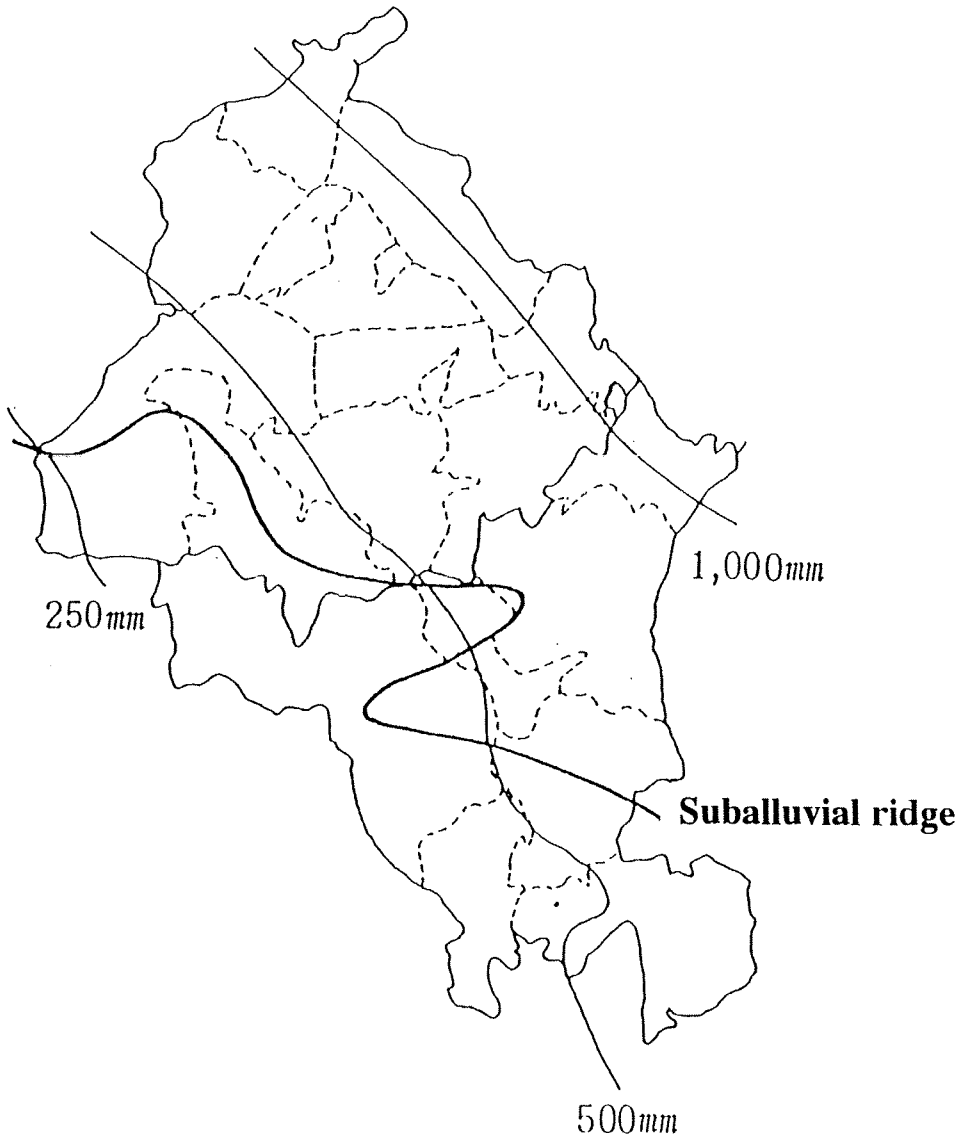
## Figure 5 Trends in Land Productivity

Unit : 1000 kg




Source : Same as Table 1.

## Figure 6 Annual Precipitation and Suballuvial Ridge

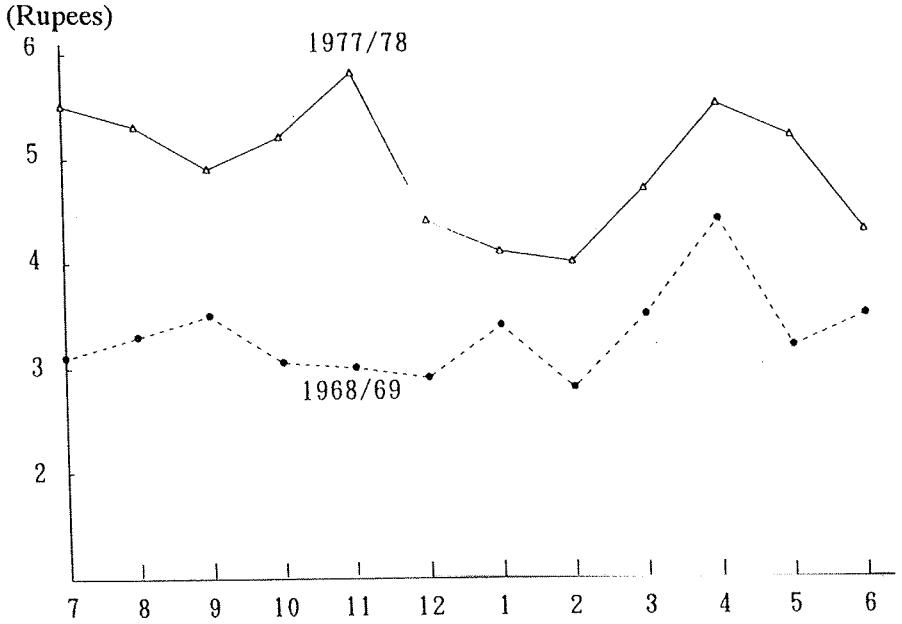



Source:

Annual precipitation : Gurdev Sigh Gosal and B.S. Ojha, Agricultural Land-use in Punjab – A Spatial Analysis, The Indian Institute of Public Administration, New Delhi, 1967.

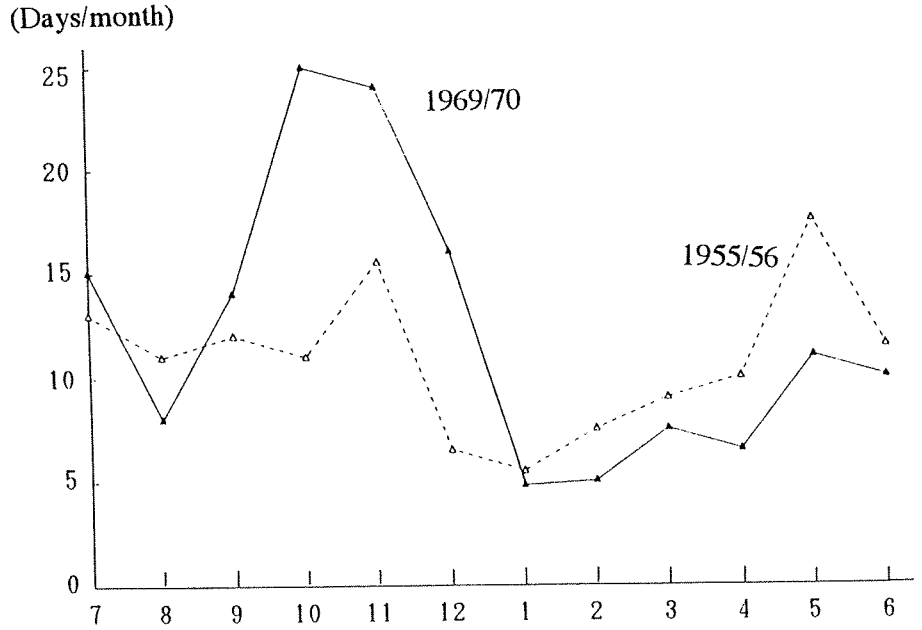
Suballuvial ridge : Reference from H.L. Uppal, "Rise of Watertable in Arid Tracks of Punjab and Haryana its Potential – A Key to Desert Reclamation", *The Annual Journal*, Vol. 12, The Institute of Engineers (India), May 1973.

## Figure 7 Changes in Actual Farm Wages by Month




Source : Compiled from Haryana (India), *Economic and Statistical Organization, Economics of Farming in Haryana, 1968/69 & 1977/78*, and India, Government of Haryana, *Statistical Abstract of Haryana*, yearly issues.

## Figure 8 Changes in Animal Labor Days by Month

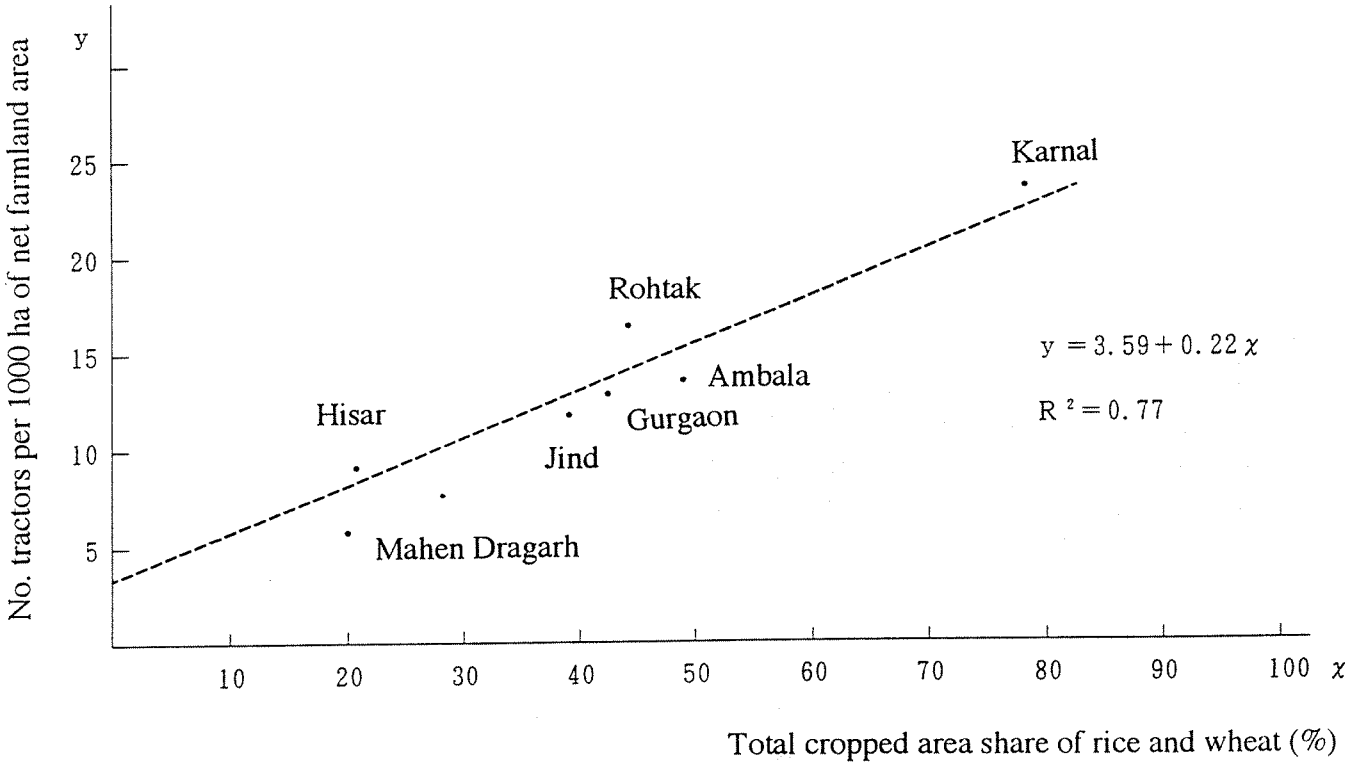



Source:

For 1955/56 : Directorate of Economics and Statistics, Ministry of Agriculture (India), *Studies in Economics of Farm Management in Punjab 1955/56.*

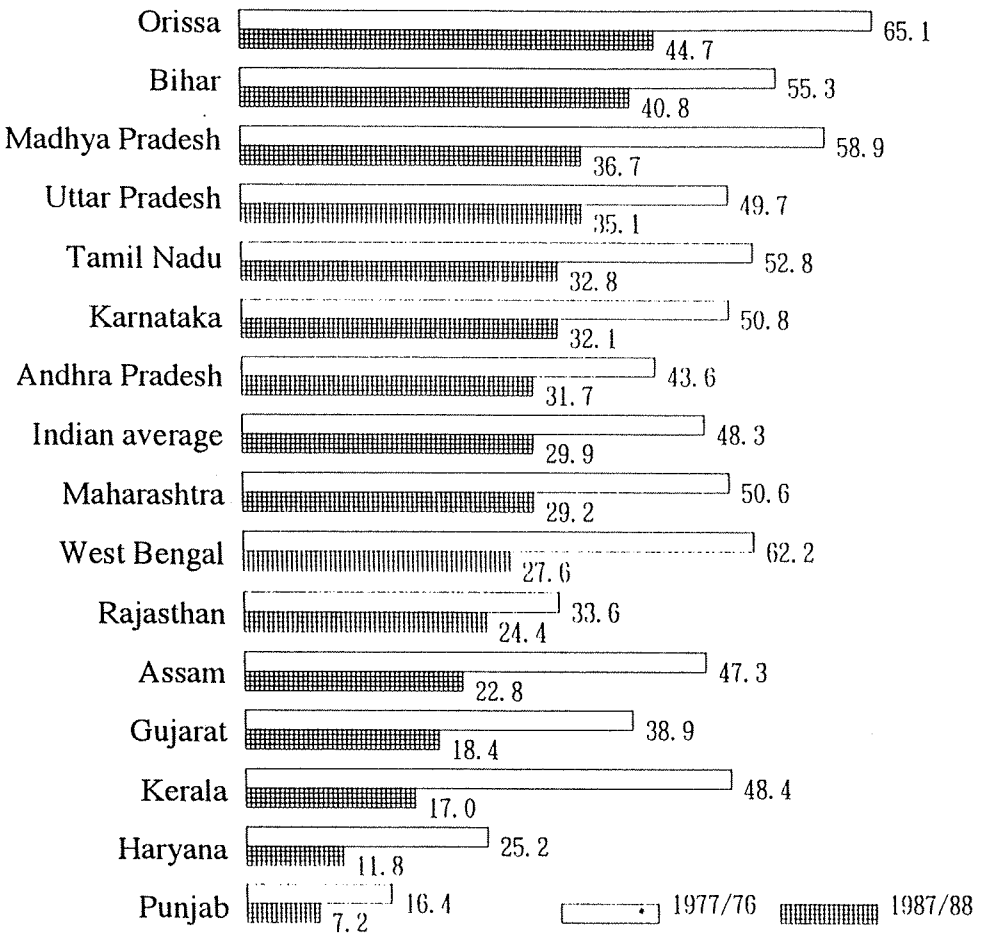
For 1969/70 :

**Figure 9 Double-cropping of Rice and Wheat and the Spread of Tractors (1980)**




Source : Same as Table 1.

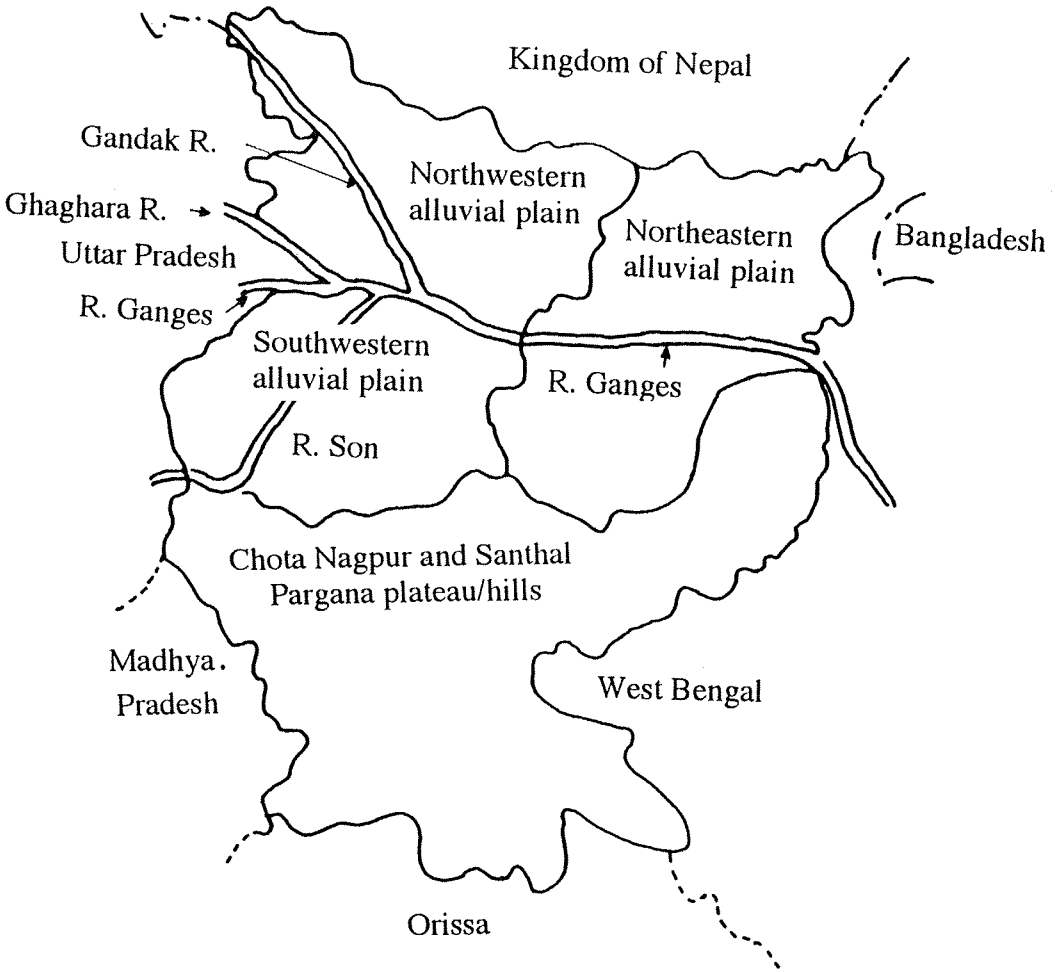
## Figure 10 Percentage of Population Below the Poverty Line




Source : Hiroshi Sato, "Indo keizai no chiiki bunseki" (Regional Analysis of the Indian Economy), Kokinshoin, 1994, p. 124.

Original source : Economic Intelligence Service, Basic Statistics Relating to the Indian Economy, Vol. 2 : States, Center for Monitoring Indian Economy, Bombay, 1991, Figures 14 and 10.

## Figure 11 Agricultural Regions of Bihar




—·— Country border

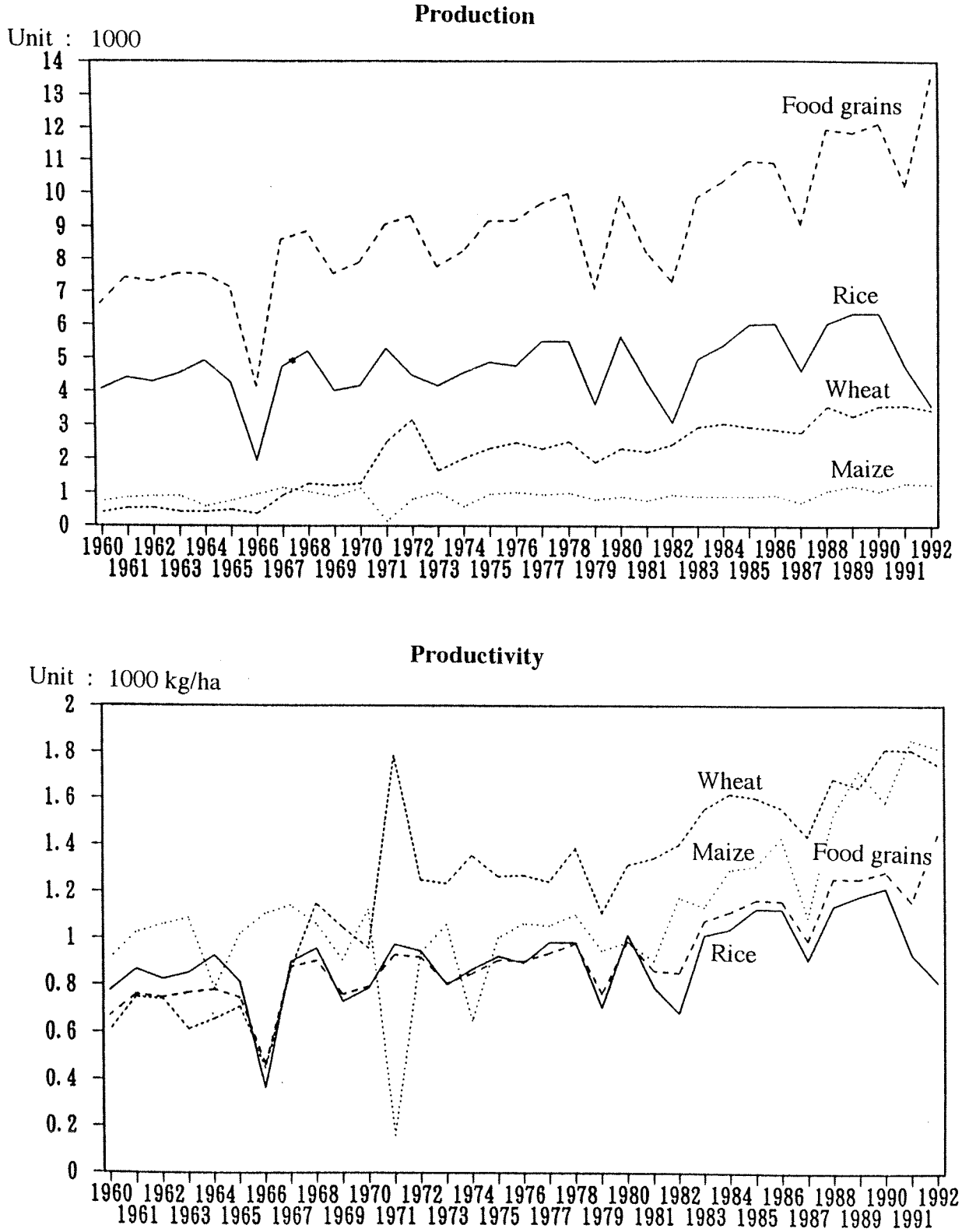
------- State border

——— State

═══ River

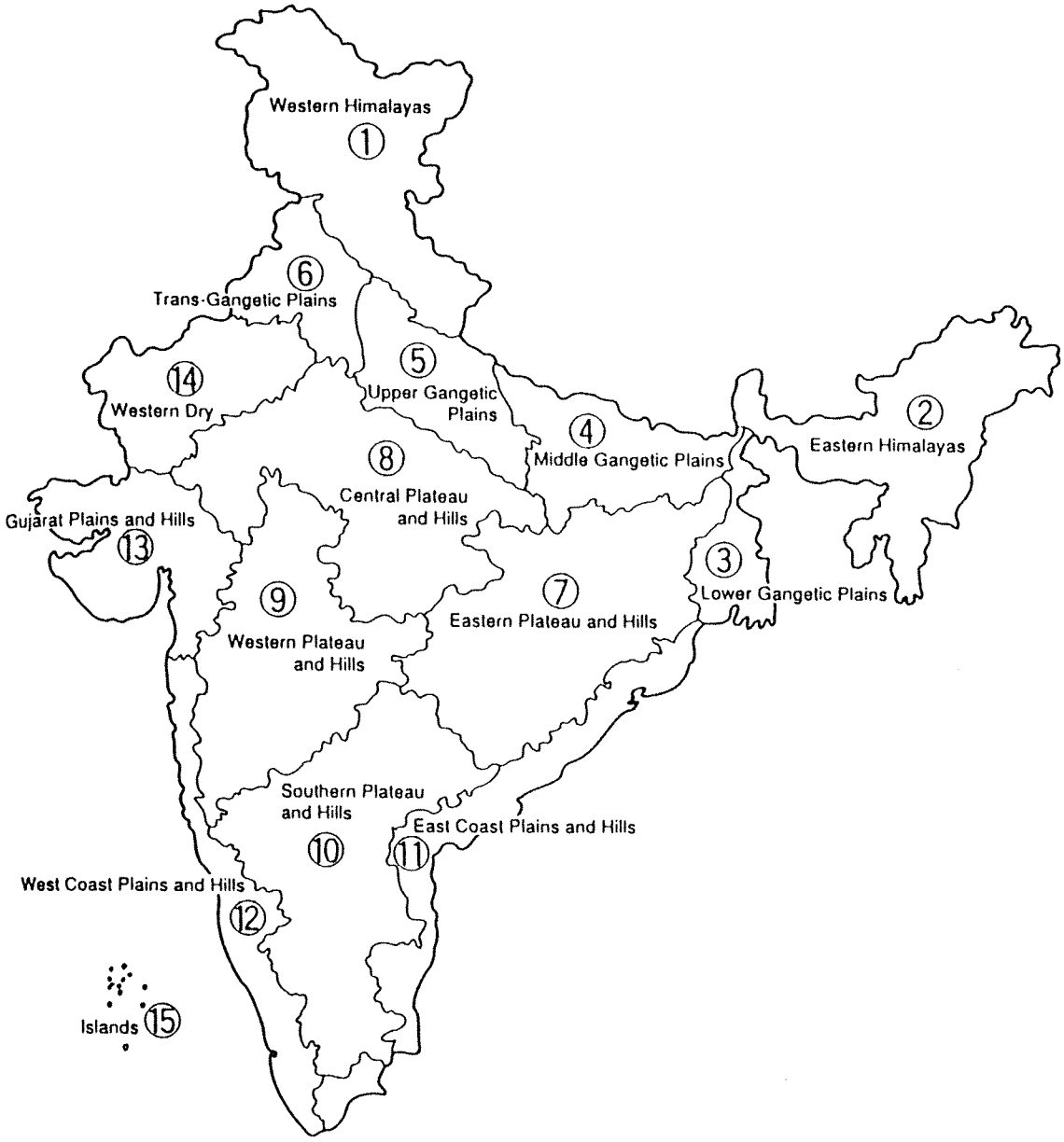
——— Agricultural region

## Figure 12 Production and Productivity of Major Grains in Bihar




Source : Center for Monitoring Indian Economy, "Agricultural Production in Major States 1949-50 to 1978-88" and Bihar government materials.

## Figure 13 Classification of Agricultural Regions in India



# Chapter Three

# Issues and Perspectives on the Development of Agriculture in India

## 1 Issues

In this chapter we will consider issues and perspectives on Indian agriculture in view of the discussions in the previous chapters.

Currently the main thrust of agricultural development in India is the introduction of new technologies, such as high-yielding varieties of seeds developed in the "Green Revolution", which began in the second half of the 1960s. This has resulted in an increase in food production, with India reaching virtual self-sufficiency in the second half of the 1970s. However, this Green Revolution focused primarily on wheat and rice, and increases in other produce are lagging.

In other words, India's self-sufficiency for food production is due mainly to the increased production of wheat and rice. Considering that about one third of the total population of India lives below the poverty line, there is a need to further increase the supply of food.

The fact that increases in food production leaned toward wheat and rice has also had an influence on consumption patterns. With diets centered on cereals, there is a need to consider nutritional balance, and in this sense as well there is a need for the diversification of food production.

Furthermore, the problem of poverty is intimately related to agriculture and rural society, and for this reason agricultural development has a major role to play. On this front the series of income and employment creation projects carried out with priority since the 1980s within India's agricultural development strategy deserve praise, and such improvements as the emphasis of the Public Distribution System (PDS) on lagging regions are indicative of a new attitude. However, there are many regional disparities in the outcomes of the agricultural development policies, and substantial regional differences in the degree of poverty as well. Considering this, there is a need for more detailed consideration in future attempts to solve the problem of poverty, and a need for policies to be managed with greater cooperation between the local organizations and the central and state governments.

Dealing with the above issues means working on the problem of unequal income distribution so conspicuous in India, and in particular importance of increasing the lower classes income-level. It also means expanding India's domestic market, and should be given special attention in the light of the current tide of economic liberalization.

## 2 Constraints

### (1) Natural conditions

India displays major regional differences in natural conditions. In order to clarify the contrast between advanced regions and underdeveloped regions, mainly in terms of developmental stages in our survey, we selected regions with relatively similar natural conditions. Though situated respectively in the upper and lower reaches of the Ganges plain, the relatively – fertile land offers favorable conditions for agricultural production both in the two regions surveyed. The hilly and mountainous regions, have more serious natural conditions for agricultural development. The development in this region is also related to issues of environmental protection, and must be given careful consideration in the future.

### (2) Social restrictions

India is a society with a particularly distinctive social structure.

The greatest distinction is the problem of the caste system, or more correctly "jajimani" system which differs slightly from region to region and can be thought to have substantial influences on the economic and social structure of the region.

This can be seen in the contrast between the states of Punjab and Haryana on the one hand and Bihar on the other which we surveyed. In the former states, the dominant castes are farming castes. In them, mutual-exchange of land has been actively promoted and efforts have been made to improve the efficiency of agricultural production. In Bihar the dominant castes

are land-owners, who do not have a strong direct interest in agricultural production, and this has created a tendency for the inefficient concentration of land.

The fragmentation of land as well as concentration of holding is influenced not only by the caste system, but is also intimately related to the tradition of inheritance. For accelerating the agricultural development in this region, it is fundamentally necessary to improve the efficiency of irrigation-facilities through mutual-exchange of fragmented holdings. In this sense, there exists an urgent need for land reforms.

### (3) Physical infrastructure

As mentioned above, the thrust of agricultural development in India has been the introduction of high-yielding varieties of seeds, particularly for rice and wheat. This requires irrigation and power, especially electric power, for the use of irrigation facilities. In the states of Punjab and Haryana, major developments have been achieved in agriculture through the introduction of high-yielding varieties. The irrigation rate for rice and wheat in these regions is virtually 100%, so in this sense the limit has in effect been reached.

The upper-difficulty is formed in regions dependent on rain-fed water alone. The establishment or maintenance of such physical infrastructure as irrigation and electric power is related to natural and social conditions, and also greatly related to the financial problems of state governments. The financial burden of the agricultural development projects is divided roughly in half between the central and state governments. In the under-developed states the level of investment in agriculture is inevitably low, and the current situation appears to form a sort of vicious circle.

## 3 Development Potentials

### (1) The tide of economic liberalization

The strategy of liberalizing the economy which India has been implementing since the 1980s is being promoted more aggressively in the 1990s. This influences the agriculture sector in many ways. One influence is the improved efficiency of the economy as a whole, involving reductions in subsidies and a relaxing of price supports and restrictions. This promotes competition and leads to improvements to previous inefficiencies on the supply side. In particular, reductions to fertilizer subsidies and relaxing of price support policies in the agriculture sector have brought about major changes in the investment and output structure. However, unless some of the issues mentioned above are resolved to a certain extent, the profitability of the agriculture sector will be lower than that of manufacturing industries, this will result in a decrease in investments in agriculture, thus leaving the agriculture sector behind

in the tide of economic liberalization.

Furthermore, economic liberalization policies, and in particular trade liberalization policies, play an active role in changing the structure of the agriculture sector. The devaluation of the exchange rate and the move towards a fully floating exchange rate system are leading to growth of the exportable agricultural commodities, which has always been an important sector for acquiring foreign currencies, This movement can be expected to promote a transition towards high-priced commodities having comparative advantages, instead of grains, thereby leading to a diversification of food production.

Currently, economic liberalization policies seem to be focused primarily on manufactured goods, but they may induce the greater changes in the economic relationship between the agriculture and non-agriculture sectors.

### (2) Policy management

In the 1980s, policy management in the agriculture sector began to display slight changes. One such change is the attempt to correct disparities between regions and classes. This can be seen clearly in agriculture development policies. On the other hand, the application of economic liberalization policies to the agriculture sector is being promoted. One manifestation of this is the reduction of various types of subsidies brought about due to financial deficits at the beginning of the 1990s, changes of the taxation of the agriculture sector are also being attempted.

However, even greater cooperation between the central and state governments is necessary for the healthy management of these liberalization policies. As of now, it seems that the difficulties involved in administrative organizations regarding to decision-making and management of development funds are becoming increasingly apparent. This difficulty is closely related to the political characteristics of state governments, but such cooperation is indispensable to achieve further agricultural development.

## 4 International Cooperation

As we have seen, many of the problems facing agricultural development in India are extremely difficult. The problems posed by India's social and political characteristics in particular surpass the category of international cooperation.

However, India is a country with substantial potential for agricultural development. The state of Bihar which we studied for this survey is extremely rich in natural resources, but is a typical example of a region which has not been able to achieve full agricultural development because of a lack of irrigation facilities and other physical infrastructure. In particular, in many

cases the underdeveloped regions of India as typified by the rain-fed areas in the lower reaches of the Ganges plain are not able to establish physical infrastructure due to weak financial foundations. Assistance from the developed countries and the international organizations on this front would be quite significant. In addition, in the tide of economic liberalization, strengthening the ties between urban and rural areas is necessary in order to expand the domestic market, so cooperation on improving roads and means of transportation would be significant. It is important to emphasize here that international assistance in these fields must take a form in which development capital reaches all the way down to the grass-root level organizations.

Furthermore, international exchanges of opinions on technology should also be conducted actively. The development of technology for hilly and mountainous regions is a major issue in Japan as well, and there are many cases in which good results are being achieved in other countries. Even though forming new international schemes for conducting cooperation runs a high risk of involving difficulties, exchanges of opinions on technology is an effective measures for the flexible implementation of cooperation between India and many other countries. The form of such cooperation is intimately related to the issue of environmental protection in the future, and we believe such cooperation activities amongst different countries will gain importance.

# Chapter Four

## Survey Members and Itinerary

# 1. Survey Members

## (1) Committee in Japan

| | |
|---|---|
| Shigeto Kawano | Professor Emeritus, the University of Tokyo |
| Yonosuke Hara | Professor, Institute of Oriental Culture. The University of Tokyo |
| Seiichi Fukui | Associate Professor, Faculty of Agriculture, Kyushu University |
| Akihiko Ohno | Associate Professor, Faculty of Economics. Osaka City University |
| Tomomi Otsuka | Assistant Professor, College of Humanities and Sciences, Nihon University |
| Hisato Shuto | Graduate School of the University of Tokyo |
| Tsuguo Hirose | Executive Director, Secretary General, Asian Population and Development Association (APDA) |
| Masaaki Endo | Assistant Secretary General. Asian Population and Development Association (APDA) |
| Osamu Kusumoto | Senior Researcher, Asian Population and Development Association (APDA) |

## (2) Preliminary Survey Members (July 24 - July 31, 1994)

| | |
|---|---|
| Akihiko Ohno | Survey team leader (see above) |
| Osamu Kusumoto | Survey team member (see above) |

### (3) Survey Members (November 21 - December 4, 1994)

| | |
|---|---|
| Seiichi Fukui | Survey team leader (see above) |
| Tomomi Otsuka | Survey team member (see above) |
| Hisato Shuto | Survey team member (see above) |
| Osamu Kusumoto | Survey team member (see above) |

## 2. Cooperator

### (1) The Embassy of Japan

| | |
|---|---|
| Chusei Yamada | Ambassador |
| Takamichi Okabe | Councilor |
| Masato Fukushima | First Secretary |

### (2) Related institutions

| | |
|---|---|
| Yoshitaro Fuwa | Chief Representative, OECF |
| Seibo Hirashima | Professor, Meiji Gakuin University |

### (3) Government and Institutions

| | |
|---|---|
| Mr. Barlam Jakhar | Union Minister of Agriculture, Government of India. |
| Mr. Sataram Kesri | Union Minister of Welfare, Government of India. |
| Mr. Sardar Beant Singh | Chief Minister of Punjub, Government of Punjub. |

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| Mr. Bhajan Lall | Chief Minister of Haryana, Government of Haryana. |
| Mr. S. S. Sisodia | Ex- Union Minister of Finance, Government of India. |
| Mr.Ramjiwan Singh | Minister of Agriculture. Government of Bihar. |
| Mr. Virendra Kataria | Member of Parliament. |
| Mr. Sant Ram Singla | Member of Parliament. |
| Mr. S. Sathyam | Secretary, Department of Statistics, Government of India. |
| Dr. S. N. Ray | Director General, Central Statistical Organization, Ministry of Planning, Department of Statistics. |
| Mr. Jaydirh Singh | Director, NSSO (Field Operation Division), Ministry of Planning, Department of Statistics. |
| Mr. V. J. Iyer | Field Director, NSSO. |
| Mr. R. N. Gupta | Commissioner and Secretary (Agriculture), Punjub State Government |
| Mr. M. K. Miglani | Commissioner & Secretary to Government of Haryana, Agriculture Department, Haryana Civil Secretariat. |
| Dr. Bains Singh | Director of Agriculture, Punjub State Government. |
| Mr. Mahesh Inder Pal Mondgil | Director of Statistics, Punjub State Government. |
| Mr. Arya | Vice Chancellor, Haryana Agricultural University. |
| Dr. G. S. Ram | Economic & Statistical Advisor, Department of Agriculture and Cooperation, Ministry of Agriculture. |

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|---|---|
| Mr. T. Singh | Joint Director, Cost of Cultivation, Ministry of Agriculture. |
| Mr. H. S. Rastogi | Deputy Economic Adviser, Cost of Cultivation, Ministry of Agriculture. |
| Mr. Kanhaiya Chaudhary | Protocol Officer, Department of Agricultural Research & Education, ICAR, Ministry of Agriculture. |
| Dr. L. N. Jindla | Joint Commissioner (food crops), Ministry of Agriculture. |
| Dr. S. K. Midha | Asst., Director General, (PP) ICAR, Ministry of Agriculture. |
| Dr. O. P. Dubey | Principal Scientist, ICAR, Ministry of Agriculture. |
| Dr. A. K. Bawa | Senior Scientist, ICAR, Ministry of Agriculture. |
| Dr. D. P. Singh | Asst. Director General, ICAR, Ministry of Agriculture. |
| Dr. M. Rai | Deputy Director General (Crops) ICAR, Ministry of Agriculture. |
| Mr. I. R. Khurana | Ex - Addl. Economic Advisor, Ministry of Agriculture. |
| Mr. B. K. Prasad | Chief Librarian Cum Documentation Officer, Planning Commission. |
| Mr. Manmohan Sharma | Executive Secretary, IAPPD (Indian Association of Parliamentarians on Population and Development). |
| Dr. M. K. Mathur | Joint Adviser, Agriculture Division, Planning Commission. |
| Mr. Ashok Mathur | A-6 Kailash Colony, New Delhi 110048 |
| Dr. Parmatma Singh | Professor, Division of Agricultural Economics, Indian Agricultural Research Institute (IARI). |

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|---|---|
| Dr. S. Selvarajan | Senior Scientist, Water Technology Center, Indian Agricultural Research Institute (IARI). |
| Dr. Mruthyunjaya | Principal Scientist, Division of Agricultural Economy, IARI. |
| Dr. S. P. Sharma | Head, Division of Seed science and technology, IARI. |
| Dr. B. P. Sinha | Head, Division of Agricultural Extension, IARI. |
| Dr. Praduman Kma | Head, Division of Agricultural Economics, IARI. |
| Dr. Mahendra K. Premi | Professor in Demography, Center for the Study of Regional Development, School of Social Sciences, Jawaharlal Nehru University. |
| Dr. Sukhadeo Thorat | Associate Professor, Center for the Study of Regional Development, School of Social Sciences, Jawaharlal Nehru University. |
| Dr. R. K. Sharma | Associate Professor, Center for the Regional Development, School of Social Sciences, Jawaharlal Nehru University. |
| Dr. Kanchan Chopra | Professor, Institute of Economic Growth (IEG), University Enclave. |
| Prof. S. K. Ray | Professor, IEG, University Enclave. |
| Prof. B. D. Dhawan | Professor, IEG, University Enclave. |
| Dr. Ramesh Chand | Reader, IEG, University Enclave. |
| Dr. R. Maria Saleth | Reader, IEG, University Enclave. |
| Dr. A. S. Faroda | Director of Extension Education, Haryana Agricultural University. |

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| Dr. N. P. N. Jha | Ex - Vice Chancellor, Dean, Agriculture, Rajendra Agricultural University. |
| Mr. Birroy N. Verrms | University Professor & Chairman, Department of Agricultural Economics, Rajendra Agricultural University. |
| Dr. A. K. Srivastava | Dean, Faculty of Basic Sciences and Humanities & Director Research, Rajendra Agricultural University. |
| Dr. Beiwry N. Verms | University Professor & Chairman Department of Agricultural Economics, Rajendra Agricultural University. |
| Dr. A. K. Srivastava | Dean, Faculty of Basic Sciences & Humanities, Director Research Rajendra Agricultural University. |
| Dr. B. Prasad | Dean, Veterinary & Animal Services, Rajendra Agricultural University. |
| Dr. S. F. Hameed | Assor. Director of Research Division, Rajendra Agricultural University. |
| Dr. H. N. Prasad | Director, Administration, Rajendra Agricultural University |
| Dr. S. S. Mishra | Chief Scientist, Department of Agronomy, Rajendra Agricultural University. |
| Dr. D. D. Guru | Professor of Agricultural Economics, Head of Economic Division, A. N. Sinha Institute of Social Studies. |
| Mr. K. C. Saha | Director, A. N. Sinha Institute of Social Studies. |
| Dr. Nadeem Mohsin | Division of Economics, A. N. Sinha Institute of Social Studies. |
| Dr. Jagdish Prasad | Lecturer (Assistant Professor) Department of Economics, A. N. Sinha Institute of Social Studies. |

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|---|---|
| Dr. Indradeo Sharma | Reader in Economics, A. N. Sinha Institute of Social Studies. |
| Mr. B. K. Basak | Chief Secretary, Bihar Government. |
| Mr. P. P. Sharma | Area Development Commissioner & Chairman Sone Command Area Development Agency (Sone CADA). |
| Mr. M. K. Mandal | Secretary Agriculture (Special Program) & Minior Irrigation Department, Government of Bihar. |
| Mr. C. M. Jha | Agricultural Production Commissioner, Bihar State Government. |
| Mr. U. S. P. Thakur | Addl. Secretary, Agriculture Department, Bihar State Government. |
| Mr. S. P. Baitha | Director, Soil Conservation, Agriculture Department, Bihar State Government. |
| Mr. Daya Nand Bhafat | Director, Agriculture, Government of Bihar. |
| Mr. R. K. Srivastaua | Addl. Secretary, Agriculture Department, Bihar State Government. |
| Prof. Rajeshwar Mishra | Director, Social Research and Extension Division, Sone Command Area Development Agency. |
| Mr. P. C. Roy | S.E.M.I. Department, Agriculture Department, Bihar State Government. |
| Mr. A. Rauf | Joint Director of Agriculture, Agriculture Department, Bihar State Government. |
| Mr. M. N. Lal | Joint Director of Agriculture (Statistics), Agriculture Department, Bihar State Government. |

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| Mr. C. D. Jha | Director (Economics and Statistics), Patna, Bihar. |
| Mr. P. C. Mishras | Deputy Director of Agriculture, Agriculture Department, Bihar State Government. |
| Mr. R. N. Shakla | Water Resource Department, Agriculture Department, Bihar State Government. |
| Mr. Y. N. P. Yadav | DAO, Agriculture Department, Bihar State Government. |
| Mr. Gangadhar Jha | Director Statistics, Bihar State Government. |
| Mr. Roy Mahendra | Joint Director of Statistics, Bihar State Government. |
| Dr. Onkareshwar Prasad | Sr. Joint Director of Statistics, Bihar State Government. |
| Mr. Gampune Kumar | Joint Director of Statistics, Bihar State Government. |
| Mr. Singh Bijay Pralap | Joint Director of Statistics, Bihar State Government. |
| Mr. Pandey Bisheshwar | Assistant Director of Statistics, Bihar State Government. |
| Mr. Jha Chandranand | Assistant Director of Statistics, Bihar State Government. |
| Mr. Shambhn Prasad | Joint Director of Statistics, Bihar State Government. |
| Mr. Mahimanand Mishra | Subdivisional Agricultural Officer, Agriculture Department, Bihar State Government. |
| Mr. Rajibala Verma | Registrate, Gaya, Bihar. |
| Mr. B. Nijalingappa | Managing Director, SCADA Agro Forestry Company LTD. |
| Mr. M. I. Ansari | Managing Director, SCADA Agro Business Company LTD. |

# Preliminary Survey Itinerary
# Basic Survey on Agricultural and Rural Development
# by
# Progress Stage in Asian Countries
# - India -
# 24th July - 31th July 1994

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**July 24 (Sun.)**

- Depart from Narita at 12:30 (AI 301) Arrive at Delhi at 18:40.

**July 25 (Mon.)**

- Visit to the Embassy of Japan. Pay a courtesy call on H. E. Chusei Yamada, Ambassador, discuss with Mr. Masato Fukushima on Indian agricultural situation.
- Visit to Ministry of Agriculture. Briefing on agricultural economy of India by Mr. G. S. Ram, Economic & Statistical Advisor, Department of Agriculture and Cooperation, Ministry of Agriculture.

**July 26 (Tue.)**

- Move from Delhi to Chandigarh.
- Visit to Department of Agriculture, Punjab State Government. Briefing on agricultural situation of Punjab by R. N. Gupta, Secretary.

**July 27 (Wed.)**

- Pay a courtesy call on H. E. Sardar Beant Singh, Chief Minister of Punjab State.
- Visit to farmers house at Chatauri village. Observing the field survey on irrigation agriculture and agricultural diversification in Punjab State.
- Visit to the Statistical Office of Punjab State Government. Material collection.
- Visit to Department of Agriculture, Haryana State Government. Briefing on agricultural situation of Haryana by M. K. Miglani, Secretary.

- Pay a courtesy call on H. E. Mr. Bhajan Lall, Chief Minister of Haryana State.
- Visit to the Statistical Office of Haryana State Government. Material collection.

**July 28 (Thu.)**

- Move from Chandigarh to Hisar.
- Visit to Umri village, Kurkshetra district. Observing the field survey of rural area.
- Visit to Haryana Agricultural University. Briefing on agricultural development in Haryana by Dr. Arya, Vice Chancellor of Haryana Agricultural University and others.
- Move from Hisar to Delhi.

**July 29 (Fri.)**

- Material collection at Grugaon.
- Visit to the Embassy of Japan, report of survey findings.
- Visit to Ministry of Agriculture, discuss with Dr. G. S. Ram, for preparing the main survey.

**July 30 (Sat.)**

- Report of survey findings to Mr. Manmohan Sharma, Executive Secretary, the Indian Association of Parliamentarians on Population and Development (IAPPD).
- Depart from Delhi (AI 308) 22:30

**July 31 (Sun.)**

- Arrive at Narita 9:05

# Survey Itinerary
# Basic Survey on Agricultural and Rural Development
# by
# Progress Stage in Asian Countries
# - India -
# 20th Nov. - 4th Dec. 1994

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**Nov. 20 (Sun.)**

- Depart from Narita At 12:30 (AI 301) Arrive at Delhi at 18:40

**Nov. 21 (Mon.)**

- Visit to the Embassy of Japan, discuss with Mr. Masato Fukushima on Indian agricultural situation
- Visit to Ministry of Agriculture, Briefing on agricultural economy of India by Dr. G. S. Ram, Economic & Statistical Advisor, Department of Agriculture and Cooperation, Ministry of Agriculture

**Nov. 22 (Tue.)**

- Visit to Indian Agricultural Research Institute (IARI), Briefing on Indian agricultural development by Dr. Parmatma Singh, Professor, Division of Agricultural Economics
- Visit to Jawaharlal Nehru University, Briefing on regional development of India by Dr. Mahendra K. Premi, Professor in Demography, Center for the Study of Development, School of Social Sciences.
- Visit to Institute of Economic Growth (IEG), Briefing on agricultural economy of India by Dr. S. N. Mishra, Professor of IEG.
- Depart from Narita At 10:35 (CX 501) Arrive at Delhi at 20:00 (Mr. Tomomi Otsuka)

**Nov. 23 (Wed.)**

- Visit to Economic Planning Commission. Briefing on Indian economic policy, especially agricultural economic policy by Dr. M. K. Mathur Joint Advisor, Agriculture Division
- Visit to Department of Statistics. Briefing on statistics of India by Mr. S. Sathyam, Secretary, Department of Statistics and others.

**Nov. 24 (Thu.)**

- Move from Delhi to Bihar IC 809
- Visit to A. N. Sinha Institute of Social Studies. Briefing on the situation of socio-economic development in Bihar by Dr. K. C. Saha, Director.
- Visit to the Sone CADA. Briefing on the development of Sone River Area by P. P. Sharma, Chairman.

**Nov. 25 (Fri.)**

- Visit to Agricultural Production Committee, State Government of Bihar. Briefing on agricultural and rural situation of Bihar, by M. K. Mandal, Secretary, Department of Agriculture.
- Visit to Bihar Statistic Office. Briefing on statistics of Bihar by Gangadhar Jha, Director of Statistics and Material Collection.
- Visit to the Department of Agriculture. Pay a courtesy call to Hon. Ramjiwan Singh, Minister of Agriculture, the Bihar State Government.

**Nov. 26 (Sat.)**

- Visit to Institute of Seed production, soil and other institute of Sone CADA.
- Move from Patna to Gaya.

**Nov. 27 (Sun.)**

- Field survey of southern part of Bihar.
- Move from Gaya to Patna.

**Nov. 28 (Mon.)**

- Move from Patna to Pusa.
- Field survey of Northern part of Bihar.

**Nov. 29 (Tue.)**

- Visit to the vegetable market of Pusa.

- Observe the village industry at Pusa.
- Visit to Rajendra Agricultural University. Briefing on agricultural development of Bihar by N. P. N. Jha, Ex-Vice Chancellor and others.
- Move from Pusa to Patna.

**Nov. 30 (Wed.)**

- Move from Bihar to Delhi (IC 809)
- Visit to Indian Council of Agricultural Research (ICAR). Briefing on diversity of Indian agriculture, by M. Rai, Deputy Director General.
- Pay a courtesy call to H. E. Mr. Sataram Kesri, Union Minister of Welfare.
- Pay a courtesy call to H. E. Mr. Barlam Jakhar, Union Minister of Agriculture.
- Depart from Delhi 22:40 (AI 304) to Tokyo (Mr. Tomomi Otsuka)

**Dec. 1 (Thu.)**

- Field survey of suburban area (Area of Delhi Development Authority). Observing the survey on vegetable production in urban.
- Discuss with Mr. Yoshitaro Fuwa, chief resident of OECF on the economic cooperation between Japan and India.
- Arrive at Narita 9:30 (AI 304) (Mr. Tomomi Otsuka)

**Dec. 2 (Fri.)**

- Visit to the Embassy of Japan, report of survey result to Mr.Takamichi Okabe, Counselor.
- Report of the result of survey to IAPPD Executive Secretary, Mr. Manmohan Sharma
- Material Collection

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| **Dec. 3 (Sat.)** | • Depart from Delhi at 23:55 (AI 308) |
| **Dec. 4 (Sun.)** | • 10:30 Arrive at Narita |

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