POPULATION GROWTH AND AGRICULTURAL DEVELOPMENT IN MIDDLE GANGA PLAIN (1961—71)

Dissertation submitted to the Jawaharlal Nehru University
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MASTER OF PHILOSOPHY

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CERTIFICATE

This is to certify that this dissertation entitled "POPULATION GROWTH AND AGRICULTURAL DEVELOPMENT IN MIDDLE GANGA PLAIN - (1961-71)" submitted by Mr. Mohd. Izhar Hasan in partial fulfilment of the requirements for the award of the degree of MASTER OF PHILOSOPHY, has not been previously submitted for any degree of this or any other University. This is his own work.

We recommend this dissertation be placed before the examiners for evaluation.

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PREFACE

Population and Economic Development are highly interdependent on each other. Recently many works have been carried out covering one or the other aspects of this phenomenon. However, the study of such relationship in a purely agricultural economic system has largely been neglected. Therefore, in the present study, an attempt has been made to study the nature of this inter-relationship taking the case study of 'Middle Ganga Plain' which is an agricultural economic based region.

The whole study has been divided into six chapters. Chapter I deals with the nature of the problem, theoretical postulates developed so far, literature survey and hypotheses which are supposed to be tested in the region. Chapter II explains the nature, source and limitations of the data taken for the study and the methodology adopted. Chapter III gives the brief introduction of the region in terms of its physical setting, population distribution and economy etc. Chapter IV deals with the various characteristics of population and changes therein during 1961-71. Chapter V evaluates the changes taken place in the agricultural economy in terms of area, yield, productivity, and agricultural output, and finally in Chapter VI attempt has been made to establish the possible nature of the relationship between demographic and agricultural variables. In this chapter again the hypotheses developed have been tested.

ACKNOWLEDGEMENTS

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A debt of gratitude is also owed to the other teachers of the Centre, especially Dr. S. Nangia, who inspired me to work on the problems of 'population and economic development'.

I also wish to express the debt I owe to the staff members of the libraries of 'Ministry of Agriculture, Krishi Bhavan' and 'Fertiliser Association of India', who provided me the necessary data required for the study.

It is pleasure to acknowledge the friendly assistance of those who helped me either directly or indirectly. Though it is difficult to count them by name, mention may be made of Sh. S. Malakar who helped in cartographic works and Mr. Abullais Shamsi, Mr. A.H. Rahmani and Miss Priti-rekha Daspattanayak who helped me from time to time in data calculation and tabulations, despite their own engagements. I am, however, alone responsible for any mistake or shortcomings.

Mohd. Izhar Hasan

MOHD. IZHAR HASAN.

New Delhi-67.
The 18th April '86.

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CHAPTER I

INTRODUCTION

Since the beginning of the human existence, man has been engaged in continuous interaction with the environment with a prime objective of creating better conditions of living for himself. He made use of the natural endowments, battled against the unfavourable elements, tamed the nature and adapted it to his own requirements. This whole course of interaction resulted in a considerable increase of his control over nature. The living conditions improved gradually which resulted in the development of human species in terms of its number and spatial extension. In fact this increase of population was the direct response of the expanding means of sustenance over time. This whole process reveals a very close interrelationship between population and economy.

Though the recognition can be traced far back, during the recent past, the world/wide awareness regarding the inter-dependence between population and economic development received a notable momentum. In the last few decades, the rapid population growth has added a new dimension to the nature of relationship between population and economy. The size of a population, its growth rate and age structure

are considered to have direct bearings on the level of economic development of any country. It is generally found that a larger size of population results in low average per capita income with a given level of technology. Similarly, the rapid increase in population poses a series of problems in the path of economic progress.

The problems of rapid growth are associated with providing adequate food, ensuring full employment to able bodied people etc. etc.[1] Since a sizeable amount of capital is diverted towards the sectors which are not capital forming ones, rapid increase in population is considered to be a major obstacle in the way of capital formation. In other words the rapid growth tends to diminish the amount of capital available for increasing the average per capital income.[2] The age composition of a population considered from the point of view of production is of immense importance to the economy. The higher dependency burden, as is seen in the underdeveloped or developing countries of the world today, acts as a major drawback of the economic progress.

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1. Maksakovsky, V.P. (ed.), The Economic Geography of the World, Progress Publishers, Moscow, 1979, p.15.

2. Coale, J.A. and Hoover, E.M., Population Growth and Economic Development in Low Income Countries, New Delhi, 1983, p.20.

The economic development, on the other hand, also affects the population characteristics of a country. This is, in fact, a both way process, whereby, the demographic characteristics affect the economic progress and, in turn, itself is guided by the later one. It is well acknowledged that, with the course of economic progress, per capita income rises which acts directly upon the courses of fertility and mortality. In the early stages of population growth both birth and death rates are high, leading to a very slow growth in the population. With improvements in the economic conditions, better health and medical facilities, mortality drops considerably leading to temporary spurt in the population. After some lag of time fertility also responds to the improving economy and goes down. This ultimately slows down the rate of growth in the population, as has happened in the western countries of the world. This has been discussed at greater length in the 'theory of demographic transition', which is based on the experience of the western countries' pattern of the population change as a result of economic development taken place from about 1700 A.D. upto the present day.[1] Landry (1909) was perhaps the first who

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1. Smith, Jackie (ed.), Dictionary of Geography, Arnold Heinemann, New Delhi, 1984, p.65.

identified this distinctive phases of population growth as related with productivity.[1]

In most of the underdeveloped or developing countries, however, because of the innovation of medical technology, the fall in the mortality was grafted from outside. The corresponding decline in fertility could not take place resulting in still a higher growth in the population. In India, too, almost a similar situation is seen. A phenomenal growth in India's population, during this present century, has been witnessed. The rate of growth was, however, slow during the first two decades but the increase became much faster thereafter and the population more than doubled between 1921 and 1971.[2] After independence, more specifically after 1951, substantial progress in the economy, particularly the non-agricultural sectors, have been achieved, despite the low base on which the work has started. But still agriculture holds the base of Indian economy despite concerted industrialisation in the last few decades. Agriculture contributes a higher share in the national income and supports more than two-thirds of

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1. Premi, M.K. and others, Introduction to Social Demography, New Delhi, 1983, p.144.

2. Sharma, T.C. and Coutinho, O., Economic and Commercial Geography of India, New Delhi, 1984, p.367.

the total population. Hence the development in the agricultural sector is an essential condition for the development of national economy. Despite all these the relationship between agriculture and the population directly dependent or involved in it has been largely unexplored. Here in the present study an attempt has been made to identify some of the important characteristics of the relationship between population and agricultural development taking the case study of 'the Middle Ganga Plain', a purely homogeneous agriculture based region in the Great plains of 'North India'.

Before developing a theoretical and empirical bases of the present study, it would be useful to look into the views put forward by various scholars from time to time and the empirical works done so far.

Theoretical Postulates:

There has been a wide variation in the views regarding population and economic growth. If we go back in past, we find that while at one point of time large and growing population was regarded as a good indicator of economic prosperity and power of a nation, at another point of time it was held to be a factor contributing to the poverty of a nation or society.

Although this concerns about the population and its relations with economy can be traced back even in the ancient period, till recently no systematic effort was made towards the study of such phenomenon. The Chinese, the Greeks, the Romans, all have formulated their views regarding the various problems connected with population. However, these views were politically motivated rather than guided by economic aspirations. The economic interpretation, however, started from 15th century onwards. The historical development on this subject can be traced in the following stages -

1) Pre-Malthusian view;
2) Malthus and Classical School; &
3) Marxist and Neo Marxist thinking.

PRE-MALTHUSIAN VIEWS:

The period from 15th to 18th century experienced a series of changes in man's attitude towards various aspects of life. The changing economic scenes ultimately influenced the thought process regarding population and economic system.

Mercantilism:

It was during this period that mercantilism, a politico-economic thinking grew, developed and dominated in most of the countries of Europe. The Central idea

of this was the accumulation of wealth, money and power. The principal means of these goals was the expansion of trade and development of manufacturing.[1] The result of this was that they preferred a large and growing population.

Some of the mercantile writers have gone even to the extent of claiming that wealth itself consists in the largest possible population. Petty, the father of 'Political Arithmatic' concluded that 'fewness of number is real poverty'.[2] During this period several steps were in practice to encourage fecundity and immigration of skilled persons, while out-migration was almost banned.

Physiocrats:

By the second half of the 18th century, the mercantilists started loosing their hold, especially in France, where a new thinking, popularly known as 'Physiocrats School of Thought', developed. This was in part a reaction to mercantilist thinking. The best known among the physiocrats were Quesnay and Mirabeau. They held that large and growing population was not always desirable and

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1. U.N., Determinants and Consequences of Population Trends, New York, 1973, p.35.

2. Quoted by James Bonar in Theories of Population from Raliegh to Arthur Young, Lectures delivered in the Galtonian Laboratory, University of London, 1929, p.86.

that amount of subsistence should be given first priority, which is agricultural sector not the manufacturing and trade. They said, since population is dependent upon food supply, every effort should be taken to encourage agriculture.

MALTHUS & THE CLASSICAL SCHOOL:

Though much earlier than Malthus, people had already proposed that man's capacity to reproduce is unlimited, whereas that of producing his means of subsistence is limited, it was Malthus who examined at greater length the role of population in a nation's poverty. He suggested that population increases in geometrical ratio while the increase in his subsistence follows an arithmatical ratio.

Malthus suggested that population is limited by the means of subsistence, and whenever, the means of subsistence increases, population also increases. If population crosses the limit prescribed by the means of subsistence, it is held under checks, knows as preventive and positive checks. The preventive checks, being voluntary, aim at reducing the level of fertility, while the positive checks such as famine, epidemic and other catastrophes include all those factors which tend to shorten the life span of human being. In his classic essay he held that population pressure and the diversion of too large amount of productive

resources to population are the principal causes of mass poverty.[1] Malthus believed in the diminishing returns of the land and said population growth is ultimately held under checks by resulting lack of food.

Though Malthus's 'Theory on Population' invited severe criticisms from people belonging to different walks of life, it may not be wrong to say that it was his work which prompted many others to find out a more general and rational theory on population. His work has been regarded as a very pessimistic approach to the study of population growth.

Malthus's views and the law of diminishing returns were incorporated by the classical economists in their theory of 'stationary state' which explains, how under certain circumstances, economic growth and population come to a stationary state. 'According to these classical economists, profit was the single motive force in economic growth and as long as the additional investment was expected to produce profit, capital accumulation would continue and so the demand of labour.'[2] As a result, wage would remain above the subsistence level and induce population to grow - as postulated in Malthusian Theory

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1. Premi, M.K. & others, op. cit., p.133.

2. U.N., op. cit., p.41.

also. From a certain point onwards, due to fixed quantity of land diminishing return would set in and profit would start declining, and so the wage, till the profit becomes zero and wage comes to the subsistence level.[1] Here the further growth of population ceases and economy, too, comes to a standstill. This diminishing trend is more pronounced in agriculture sector than industrial one.

It is noteworthy that even among the classical economists two approaches prevailed, one of pessimism, as discussed above, the other which saw in population growth an index of economic prosperity.[2] Adam Smith,[3] held the opinion that population means the enlargement of market and the extension of division of labour. This increasing division of labour maximises the productivity, revenue and stock with an increase in demand of labour. Thus the whole becomes favourable to economic growth.

A majority of the writers believed that the technological progress might postpone the coming of 'stationary state' of economy. Rodbertus denied the law of diminishing

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1. Ibid., p.41.

2. Coorts, S.H., Population Theories and Economic Interpretations, Routledge & Kegan Paul, 1957, p.41.

3. Smith, A., An Inquiry into the Nature and Causes of Wealth of Nations (1776, 1966 ed.), Edwin Cannon, London.

returns and stressed the view the progress in science and production was geometrical.[1] Such writers have asserted that population responds also to factors other than the limits set in by the means of subsistence. Among others who discarded the pessimistic attitude are Everett, Senior, Carry etc. Most of these classical economists regarded population as a dependent variable. Smith also wrote 'the demand for men like any other commodity necessarily regulated the production of men.[2] Smith accepted that population growth was a result of the improved economic condition. But, as Hanson pointed out, Smith also considered population increase as a cause of economic progress since it widened the market, thus creating the possibility for further division of labour. Similar view was held by other economists like James Mill, Senior and McCullock.

In spite of the fact that by end of the 19th century many issues emerged questioning the validity of opinions of classical thinking, almost same features prevailed in the writings of 'Neo Classical' economists. However, the possibility of delaying the onset of diminishing return by the operation of certain factors was recognised by almost all the writers.

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1. Coontz, S.H., op. cit., p.85.

2. U.N., op. cit., p.41.

MARXIST AND NEO-MARXIST THINKING:

Even before the works of Marx came to the scene, many other socialist writers had already criticised the Malthusian thesis. The pre-Marxist socialist writers believed that since excessive poverty led to excessive ~~poverty~~ population, it is only by eliminating poverty that the threat of excessive population could be checked. However, these writers did not formulate any theory as such.[1] It was Marx who formulated a consistent approach to the population problem which most socialist writers were later to follow.

These writers have given more importance to the means of employment than to the means of subsistence. The attribute of high fertility in the less developed countries is the result of the imperialist and the capitalist modes of production. These writers regard 'Malthusians' as being guilty of ignoring the facts of colonial and neo colonial exploitations,[2] and their interpretation of relationship between population and economic development is pessimistic, deterministic and tools of capitalist and imperialist exploitations.

In the case of the third world countries, the prevailing poverty is not due to the growth or pressure of population.

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1. Coorts, S.M., op. cit., p.85.

2. Srivastava, O.S., Demography, Vikas, New Delhi, 1983, p.245.

but just because of the relations of production prevailing in these countries, where the mass production is not the production of the masses. They say, not population control but fundamental social transformation is the essential condition for achieving a breakthrough in the third world's underdevelopment.

OTHER WRITERS:

In the recent past too, various opinions appeared at the scene. Hansen, basically an economist of America, supported increase in population and said 'for increasing the employment, population should increase'.[1] Among the supporters of his thesis, Adler and August Losch also propounded their populationist views. Losch found that the level of economic activity is the result of population increase. Colin Clark, while speaking on the occasion of the 'World Population Year (1974)' completely discarded the pessimistic attitude and stressed the economic benefits of an increasing and expanding population.

REVIEW OF THE EMPIRICAL WORKS:

Though a lot of theoretical postulates have been developed from time to time, very few empirical studies have appeared on the interrelationship between population

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1. Ibid., p.247.

and economic development. The scarcity of empirical studies is even more strongly felt in the case of the developing nations of the world. These empirical studies have focussed upon the interrelationship of economic development and the three components of population growth separately. These are - (a) futility, (b) mortality, and (c) migration. In the succeeding sections of this chapter we shall discuss in brief the works done so far.

Studies Related to Fertility:

Fertility has attracted attention of various scholars and several studies have been done from time to time. It has been emphasized that there has been a very close relationship of fertility and economic development. Sovani suggested that decline in fertility accompanies industrialisation and urbanisation, and to support his arguments he cited the experiences of some of the advanced regions of the world.[1] Whitney has explored the responses of fertility to economic development, and also decline in mortality in Mexico, for a period of twenty years from 1950 to 1970.[2] He suggested that the increase in life

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1. Sovani, N.V., Relations between Economic Pressure and Economic and Demographic Change, International Population Conference, 1969, vol.3, pp.1729-33.

2. Whitney, W. Hicks, "Economic Development and Fertility Change in Mexico - 1950-70" in Demography, Vol.11, No.3, August 1974, pp.407-21.

expectancy and decline in the share of labour force in agriculture are the most important factors which act to reduce total fertility rates over time.

Page, Kevin and Gaisie have explored the way fertility has behaved in the three different countries of Africa. Page explained the change in the birth rates of Sahara,[1] Henin studied this phenomenon for the population of Sudan,[2] while Gaisie confined to the Ghanian tribe.[3] Lindert taking data from various developing countries and for many historical periods has suggested that with the course of economic development, the cost of rearing children raises which act upon reducing the fertility rates.[4] Schultz has explained the actual declines over time in age-specific fertility rate of a less developed country undergoing the demographic transition.[5] Mahbubul in his

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1. Page, H.J., "Fertility & Child Mortality in South of Sahara" in S.H. Ominde and C.N. Ejiogu (eds.), Population Growth and Economic Development in Africa, Heinemann, London, 1972, pp.51-66.

2. Henin, R.A., "The Level and Trend of Fertility in the Sudan", op. cit., pp.77-83.

3. Gaisie, S.K., "Fertility Levels among the Ghanian Tribes", op. cit., pp.84-94.

4. Lindert, P.H., "Child Cost and Economic Development" in Easterlin, R.E. (ed.), Population and Economic Change in Developing Countries, pp.5-80.

5. Schultz, T. Paul, "An Economic Interpretation of the Decline in Fertility in a Rapidly Developing Country: Consequences of Development and Planning, op. cit., pp.209-89.

study on Europe has tried to prove that the age at marriage affected population growth in both pre and post industrial period.[1] He held that the recent population problems of the poor countries have arisen because medical advances have upset the delicate balance between population growth and economic change. Chambers established the relationship between population growth on the one hand and fertility and mortality on the other with varying significance at different points of time in England.[2] He held that the industrial revolution was possible just because of the abundant supply of labour which itself was the result of rapid population growth.

In India, too, various attempts have been made towards the study of fertility. Davis's work is considered to be a pioneering effort.[3] Among others Bole and Sinha[4], Saxena[5], Visaria[6], Raghavchari[7] and Premi[8] are very

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1. Habakkuk, H.J., "Population Growth and Economic Development since 1750" in Population Studies, vol.28, 1974, pp.

2. Chambers, J.D., Population, Economy and Society in Pre-Industrial England, Oxford Univ. Press, p.162.

3. Davis, Kingsley, Population of India and Pakistan, Princeton Univ. Press, 1951.

4. Bole, J.R. and Sinha, U.P., "Fertility and Mortality in India - 1951-60" in Ashish Bose and others (eds.), Studies in Demography, London, 1970.

5. Saxena, B.B., "Estimates of Fertility and Mortality in India from 1901 to 1961", papers submitted by the Indian Authors to the World Population Conference, Belgrade, 1965 (New Delhi, Office of the Registrar General India, 1965).

see footnotes 6, 7 & 8 on next page.

important who studied the trend of fertility for different points of time. However, their works were mainly concerned with demographic analysis and its technical aspects of measuring fertility. Coale and Hoover[1] have done a very good job by studying the various aspects of India's population and the economic development. They have discussed fertility in much greater length in terms of its relationship with economy. They suggested that the age at marriage has been continuously rising which led to considerable decline in fertility. Aggarwal[2], while explaining the fertility differentials, suggested that fertility rate is inversely related to the per capita income of the household and that different operations show varying rates of fertility.

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footnotes 6, 7 & 8 of previous page:

6. Visaria, P.M., Mortality and Fertility in India 1951-60, Milbank Memorial Fund Quarterly, vol.XLVII, No.1, Pt 1, Jan. 1969.

7. Raghavchari, S., "Population Projections - 1976-2001" in Ashish Bose and others (eds.), Population in India's Development, Delhi, 1974, pp.431-37.

8. Premi, M.K., Demographic Situation in India, East West Centre, Honolulu, 1982, p.152.

1. Coale, A.J. and Hoover, E.M., Population growth and Economic Development in Low Income Countries, New Delhi, 1983, p.389.

2. Aggarwal, S.N., Some Problems of India's Population, Bombay, 1966, p.151.

Studies Related to Mortality:

Mortality is another important component of population change. Preston[1] has studied the causes and consequences of mortality declines in the less developed countries of the world in the present century. Page[2] studies the child mortality in south Sahara. Frederikren[3] made an important attempt of studying the effects of economic change on mortality trend in Ceylon. He held that economic development by increasing per capita food consumption was an important cause of the observed mortality decline. Regarding the sudden spurt in the mortality rate during 1943-46 and the post war decline, he held that they were associated with the development and the alleviation of the war time food deficit. He discarded the postulate that economic development was no longer a prerequisite for a decline in the death rate.

A majority of the works on mortality in India, as already referred to in the case of fertility aspect, have

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1. Preston, S.H., "Causes and Consequences of Mortality Declines in Low Developed Countries - 20th Century" in R.E. Eastertin, op. cit., pp.289-360.

2. Page, H.J., op. cit.

3. Frederikren, H., "Economic Development and Mortality Declines since World War II - Case Study of Ceylon" in David M. Heer, Readings on Population, Prentice Hall, 1968, pp.74-80.

confined themselves to the technical aspects of measuring at different points of time. Davis[1] dealt with the mortality trend over time on all India level. Jain[2] also studied it by dividing India into different zones. He also worked out the All India life table for 1941-50 and 1950-60 and zonal life tables for 1951-60. Besides these he also computed the state death rate during 1941-50 and 1951-60 by differencing method. Premi[3] studied the mortality trend in India for different points of time. Mukherjee[4] has explained the history of population growth with the help of fertility and mortality rates in India.

Kohli[5] studied interstate variation of mortality at comparatively greater length for the period 1951-60. He also made significant attempt to explain the statewise as well as temporal differentials in terms of the socio-economic development and improvements in medical and public

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1. Davis, Kingsley, op. cit.

2. Jain, S.P., "State Growth rates and their Components" in Ashish Bose (ed.), Patterns of Population change in India, 1967.

3. Premi, M.K., op. cit.

4. Mukherjee, S.D., The age distribution of India's Populations A Reconstruction for the States and Territories - 1881-1961, East West Population Institute, East West Centre.

5. Kohli, K.L., Mortality in India: A Statewise Study, New Delhi, 1977, p.296.

health. He suggested that the reduction of death rate and increase in expectation of life at birth during the decade were mainly due to the development and use of antibiotics, insecticides and sulphra drugs and other advances in public health measures.

Studies Related to Migration:

Spatial mobility is equally an important component of population change, and has been studied by scholars of different disciplines such as geography, demography, economics, etc. etc. In majority of the works this has been explained in terms of the economic factors both at the place of origin and the place of destination. Stouffer's[1] model of intervening opportunities suggested the size of migrants is directly proportional to the number of opportunities at the place of destination and indirectly proportional to the intervening opportunities. Similar views were given by Vandercamp[2] regarding the spatial mobility in Canada. However, he has interpreted this movement in terms of income disparity and distance.

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1. Stouffer, S.A., "Intervening opportunities and Competing migrants", Journal of Regional Science, vol.2, pp.1-26.

2. Vandercamp, J., "Internal Mobility in Canada - A Case study of the Time pattern of Migration", Canadian Journal of Economics, vol.1, pp.595-608.

Richardson[1] said people migrate from low wage areas and areas of surplus labour areas to high wage areas and the areas of labour shortage. Davis[2] comes to the conclusion that modern migration is an ebb and flow that results from technological and income inequalities.

Various studies in the developing countries have also raised similar points. Prothero[3] for West Africa, Rempel and Todaro[4] for Kenya came to the same conclusion. Todaro[5] provides a major service in distilling the extensive 'migration model' literature summarising the results of empirical tests, and on the basis of this, identifying major policies of internal migration. In India Davis, Dayal, Gosal, Zachariah have all studies the characteristics

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1. Richardson, H.W., "Resource Mobility in Space Economy" in H.W. Richardson, Regional Growth Theory, The Macmillan Press, Ltd., London, pp.89-103.

2. Davis, K., "The Migration of Human Population", Scientific American, vol.231, No.3, pp.92-105.

3. Prothero, R.M., "Migrant Labour in West Africa", Journal of Local Administration Overseas, vol1, No.3, pp.140-55.

4. Rempel, H. and Todaro, M.P., "Rural to Urban Labour Migration in Kenya", in G.H. Omind etc., Op. cit., pp.214-31.

5. Todaro, Michael, "Internal Migration in Developing Countries - A Survey" in E. Richard, op. cit., pp.361-402.

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of internal migration. Mitra[1] related the phenomenon with the levels of development. Gulati[2] has attempted an analysis of the relationship between migrant and per capita income at both district and state levels. Mahto[3] studied the relationship between the spatial mobility and economic development in the eastern India, comprising the states of Bihar, Orissa and West Bengal. Dasgupta[4] found in his study that job scarcity and the situation of land is an important reason of outmigration from rural areas. Differentials in reward or wage, he suggested, is equally important in attracting people from rural areas to urban centres.

In the countries where agriculture still plays a very important role in the over all economy, the study of the interrelations between demographic behaviour, on

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1. Mitra, A., Internal Migration and Urbanisation in India, Part 1, Text, Part II Appendices, U.N. ESCAPE, Expert Committee Groups on Problems of Internal Migration and Urbanisation, Bangkok.

2. Quoted from Mahto, K., Population Mobility and Economic Development in Eastern India, 1985, p.13.

3. Ibid.

4. Dasgupta, Biplab, Village Society and Labour Use, Delhi Oxford Univ. Press, 1977, p.200.

the one hand, and changes occurred in the agricultural sector, on the other becomes very important. Some of the authors have focussed light on this as well.

Goliber[1], discussed the effects of population expansion on the food supply in the countries lying in the sub Saharan Africa. He taking the help of index of per capita food production, 1961-65 to 1985, drew a comparative picture of the Latin America, Asia and Sub-Saharan Africa. Sub-Saharan Africa, he held, has experienced decline in the per capita food production since 1975, while the population has grown leaps and bound. Basu, Roy and Nikhil[2], selecting the two villages of Gujarat, where bulk of population is engaged in agriculture, worked out cumulative fertility index and showed that it is lower in the village which is comparatively developed one. Bagchi[3] has studied the impact of population on the agricultural activity taking the case

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1. Thomas, J. Goliber, "Sub Saharan Africa - Population Pressure and Development" in Population Bulletin, vol.40, No.1, Feb. 1985.

2. Basu, D.N., Roy, R., and Nikhil, P., Impact of Agricultural Development on Demographic Behaviour, Pilot Study by ORG, New Delhi, 79.

3. Bagchi, J., "Population Pressure and Agricultural Change" in Noor Mohammad (ed.), Perspective in Agricultural Geography, vol.5, pp.45-54.

study of West Bengal for the decades 1951-61 and 1961-71. He found that the pressure of population has not only helped the growth of production of crops but also led to the changes in cropping pattern. He suggested that the state emerged as a major wheat, jute and sugarcane growing region supporting the extra load of population.[1] Sen and Bhattacharya[2], have studied the phenomenon from 1921-1975 in Moribund Delta of the Ganga, which covers the eastern half of Murshidabad and north-western part of Nadia district in West Bengal. They found that the growth of population and total cropped one are very disproportionate. To overcome this, they suggested more intensive cultivation. They found that only twenty five per cent of the rural population is gainfully employed and agriculture has become overburdened, requiring constructive planning for its healthy growth immediately.

Objective: In the light of the above survey we find that very few works have taken care of the factors of agricultural development and population. Most of the studies are found to have dealt with the three components of population dynamics seperetely, and major emphasis has

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1. Ibid., p.54.

2. Sen, J. and Bhattacharya, "Population Pressure and Agricultural Change" in Bhagirathi, op. cit., pp.81-103.

been given to explain these characteristics through non-agricultural variables. The present study, therefore, attempts to relate some of the important characteristics of population with the developments taken place in agriculture sector of a purely agricultural based region of India i.e. 'the Middle Ganga Plain'. The following are the main objectives of the study:

(i) to study the spatial pattern of population growth (rural) in the region along with changes in its basic characteristics such as dependency ratio, growth of workers especially agricultural workers, work-participation rate etc.;

(ii) to discover the developments taken place in agricultural sectors including total area under cultivation, improvement in yield, growth in agricultural output and levels of productivity;

(iii) and finally to establish the possible relationship between the important variables of population and agriculture.

This whole work is carried out for the period early sixties to early seventies.

Hypothesis: There would be no dispute in saying that the 'Middle Ganga Plain' enjoys an economy which is entirely based on agriculture that too absolutely

subsistence type. Hence, the response of population growth in the changes taken place in agriculture would be drastically different in this region than what can be noticed in an agriculturally advanced region. In agriculturally advanced region the increasing pressure of population on land can be seen through the further intensification of cultivation which is made possible by the available infrastructural facilities. As against this, in an agriculturally backward region the only way out seems to be the extension of cultivated area through the process of reclaiming newer lands. It is here that the gross cultivated area is increased by increase in net area sown, while in the developed regions, larger contribution to the gross cultivated area comes from growth in the multiple sown area. So the first hypothesis which we are supposed to test in the region can be put in the following manner:

(i) A positive and strong correlation exists between the growth of population and growth in gross cultivated and net cultivated area.

In agriculturally backward areas the extension of cultivated areas are not usually accompanied by the improvement in the infrastructural facilities. The new areas which are brought under cultivation need some improved and better techniques and better agricultural

inputs in growing crops, which are not available to the poor cultivators in such regions. This results in further decline in average land and labour productivity, though the gross agricultural output may report some growth. To test this, the second hypothesis may be framed up as follows:

(ii) There would be a negative correlation between population growth and the changes in the levels of productivity, viz. land productivity and labour productivity.

A third situation which follows the above discussed two condition is the fact that the deteriorating conditions of the levels of productivity would mean that the growing population pressure on land is not fully supported by the agricultural sector, and that the workers involved in it are actually not gainfully employed. In such circumstances people may tend to outmigrate from such areas to the surrounding agriculturally prosperous region or to the urban centres in search of employment. This outward movement will usually be in people under the working age groups. The result of this flow would be the secular increase in the dependency burden. To test our third and last hypothesis would be

(iii) there exists a negative correlation between the increase in the dependency burden and the improvements in land and labour productivity and agricultural output.

CHAPTER II

INTRODUCING THE AREA

Introduction: As the name signifies, 'the Middle Ganga Plain', forms the middle portion of the vast and extensive Gangetic plains formed as a result of the deposition of alluvium brought down by the river Ganges and its tributary from the Himalayas. This vast 'Gangetic Plains' spread over almost the whole Uttar Pradesh (excluding the southern portion which is the extension of the Deccan Plateau), whole of Bihar plains, and the state of West Bengal (except the northern hilly areas and some of the western portion). This great plain occupies an area of 3.57 lakh square kilometres.[1] Though there is no clear cut physical boundary the plain has been further divided into three parts. Middle Ganga plain lies in the centre and to the west of this, there is 'Upper Ganga Plain' lying north of the Yamuna and west of 100 m. contour line, and to the east lies the 'Lower Ganga Plain' which includes the whole of West Bengal excluding the Purulia district in the West and the hilly parts of the North.

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1. Sharma, T.C. and Coutinho, O., Economic and Commercial Geography of India, New Delhi, 1984, p.8.

The Middle Ganga plain includes the remaining portions of Utter Pradesh east of Allahabad-Faizabad line and the Bihar plains. Roughly it may be said that the northern limit is demarcated by the 'Indo-Nepal International' boundary, the western limit by 100 m. contour, the southern extension is limited by the 150 m. contour line and the eastern extension by the state boundary between Bihar and West Bengal.

Delimitation of the region: Any study of a geographical region involves certain difficulties. Firstly, since the geographical bases are taken, such boundaries may not necessarily correspond to the administrative boundaries, while the data are given on the basis of administrative divisions. Secondly, there is some variation in the extension of the region in the schemes suggested by various authorities. The second order division of the Gangetic plain has been proposed and accepted by various authors. In the schemes of classification of natural regions, Mcfarlane, Stamp, Pithawala and Ahmad have all demarcated these second order regions.[1] B.C. Singh[2] has worked

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1. Memoria, C.B., Bhaarat Ka Bhugol, Agra, 1978, p.7.

2. Singh, B.C., "Delimitation of Middle Ganga Plain", NGJI, XI, June 2, 1965, pp.74-83.

exclusively for demarcating the region taking the geographic factors such as terrain, climate etc. and certain socio-economic factors. R.L. Singh presented in detail the scheme of classification which is considered to be comparatively more accurate and comprehensive one. But still then, the exact lines demarcating the region well varies from one scheme to another.

Keeping this in mind, here in the present study we have made some adjustments in the schemes of R.L. Singh and S.C. Singh and have taken the administrative divisions. These authors have included the districts of Saran, Champaran (which also include small chunk of the Siwaliks in the northern part), Muzaffarpur, Darbhanga, Saharsa, Munger, Purnea (excluding the Kishanganj subdivision), all in the north Bihar plain, Shahabad, Patna and excluding the southern most strips of Gaya, Munger and Bhagalpur, in the south Bihar plain. In the eastern Uttar Pradesh the districts of Gorakhpur, Deoria, Basti, Azamgarh, Jaunpur, Ghazipur, Ballia, Varanasi (excluding the Chakia tehsil) only a small part of Mirzapur district and leaving out some western part of Gonda, Faizabad, Sultanpur, Pratapgarh and Allahabad, have been included.

In the present study we have taken all those districts whose some or the other part were not included as well as those which come fully under the region. This way the total


MIDDLE GANGA PLAIN
ADMINISTRATIVE DIVISIONS
1971
82° E
84°
86°
88° E
28°
26°
24°
22°
GONDA
GORAKHPUR
BASTI
DEORIA
CHAMPARAN
FAIZABAD
SULTANPUR
AZAMGARH
SARAN
MUZAFFARPUR
DARBHANGA
SAHARSA
PURNEA
PRATAGARH
BALLIA
JAUNPUR
GHAZIPUR
ALLAHABAD
VARANASI
SHAHABAD
PATNA
BHAGALPUR
MUNGER
MIRZAPUR
GAYA
STUDY AREA
BOUNDARIES
INTERNATIONAL
STATE
DISTRICT

Fig. 2-1

area has been raised from 144961 km^2 (as suggested by R.L. Singh[1]) to 173168 km^2. If so delimited the region extends from nearly $81^{o}10'E$ to $89^{o}7'E$ and $22^{o}52'N$ to $27^{o}3'N$ and includes the administrative divisions of Allahabad, Gonda, Faizabad, Sultanpur, Partapgarh, Basti, Gorakhpur, Deoria, Azamgarh, Jaunpur and Mirzapur districts of east Utter Pradesh and Patna, Gaya, Shahabad, Saran, Champaran, Muzaffarpur, Darbhanga, Saharsa, Purnea, Bhagalpur and Munger districts in the Bihar plains. This has been given in the Map No.2:1.

Before entering into the detailed analysis of the interrelationships between the agricultural and population characteristics of the region, it would be worthwhile to have some understanding of the relevant features of the region. In the following sections of this chapter a brief account of the region both physical and socio-economic - is given.

PHYSICAL SETTING:

Structure & Relief: Structurally, the region 'Middle Ganga Plain' forms a part of the Indo Gangetic plain with some portions of other major formations like Siwaliks in the northern part of Champaran district and Peninsular

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1. Singh, R.L., Regional Geography of India, Varanasi, p.208.

block in the south, in the Mirzapur, Gaya and Bhagalpur districts. The northern broken hilly region of Champaran district is known as the 'Dun' or 'Ramnagar Dun'.[1] The surface of the region extremely low and level with heights varying from 100 m. in the south east. The region is composed of thick alluvial deposits with varying depths. The depth, particularly, increases up to 8000 to 10000 m. as the Himalayas are approached while it thins out as a mere veneer on the Peninsular margins.[2] The Kaukar formation is relatively less because of the higher occurrence of Khadar lands, the newer deposits. The region is almost homogeneous level, seemingly featureless plain from one end to another. But heterogeneity is observed in the landscape due to river levees and bluffs or sandy features, ox-bow lakes, Tals, Chaurs, dead arms or occasionally bad lands or ravines. Still there is no jarring mound or elevated jet of land to break the monotony of the level surface. (See Map No.2:2)

Drainage: Hence drainage lines hold particular significance in the region by redeeming topographic breaks in the general flatness of the plain and also they govern

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1. Prasad, R.C., Bihar, N.B.T. Publication, New Delhi, 1983, p.4.

2. Singh, R.L., op. cit., p.190.

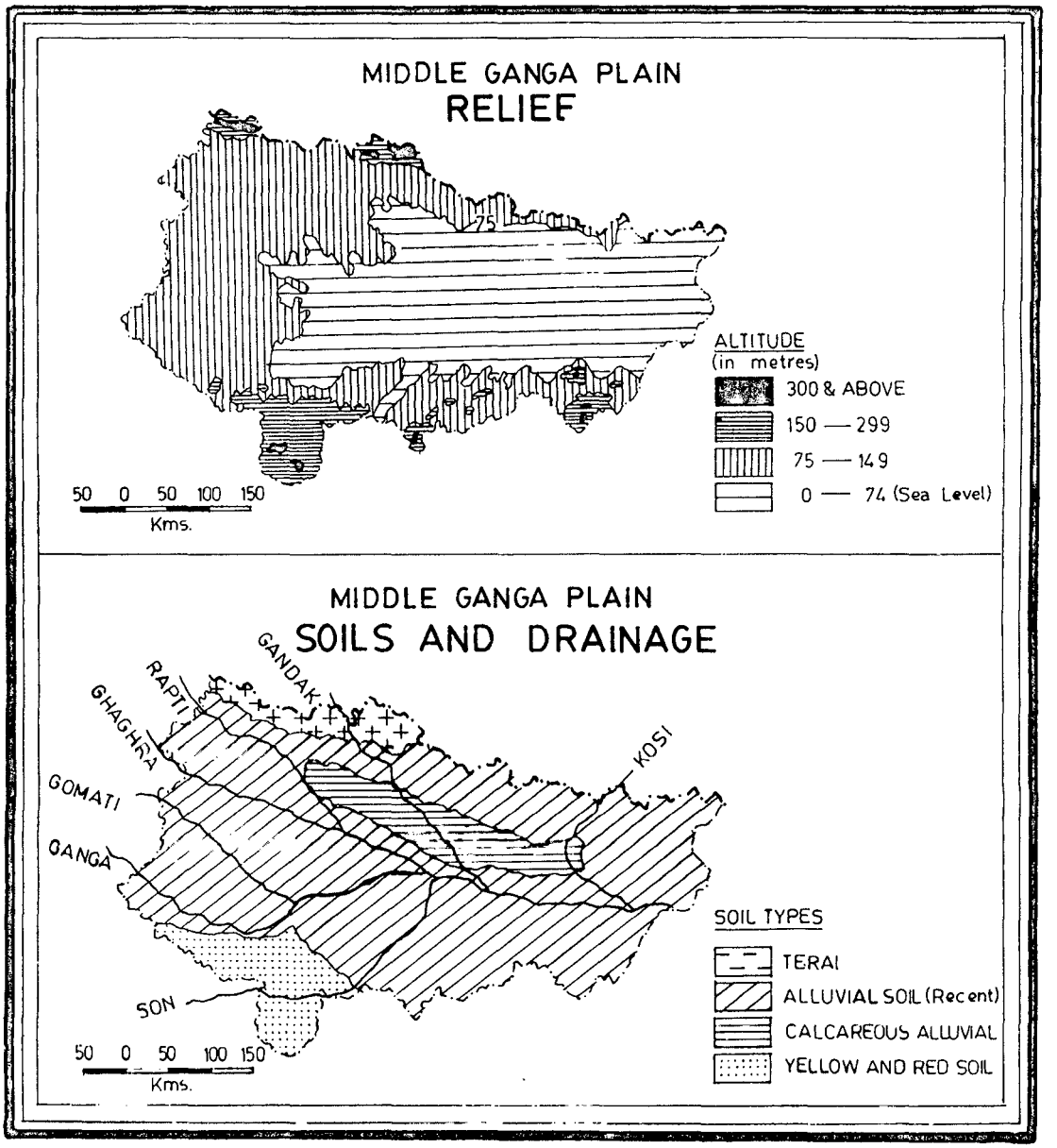
MIDDLE GANGA PLAIN
RELIEF
75
ALTITUDE
(in metres)
300 & ABOVE
150 — 299
75 — 149
0 — 74 (Sea Level)
50 0 50 100 150
Kms.
MIDDLE GANGA PLAIN
SOILS AND DRAINAGE
GANDAK
RAPTI
GHAGHRA
GOMATI
GANGA
KOSI
SON
SOIL TYPES
TERAI
ALLUVIAL SOIL (Recent)
CALCAREOUS ALLUVIAL
YELLOW AND RED SOIL
50 0 50 100 150
Kms.

Fig. 2.2 & 2.3

the human occupance of land, particularly the agricultural activities and settlements. (See Map No.2:3) Generally the drainage pattern is dendritic in nature, where the Ganga, which flows through almost the middle of the region from west to east, is the major stream and is the recipient of all water lines in the region. The Ganga, a snow-fed Himalayan river and heavily laden with detritus, flows sluggishly west to east. In the Himalayan fringe in Champaran the northern tributaries of the Ganga display the characteristics of young rivers rushing through deep and narrow gorges for example the Gandak at Bhainsalotan.[1] These hill streams play havoc by bringing down huge quantities of sand and destroying cultivable lands. They debouch into the plains through a series of rapids. Farther west of the Gandak, the Ghaghara and the Gomati from north west. Another important tributary joining from north much farther east is the Kosi.

The tributaries from south are the son and the Punpun. The son joins the Ganga near Patna. In the streams of this southern upland floods are the recurring feature, leading to breaks of transport system and

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1. Ahmad, E., Bihar: A Physical, Economic and Regional Geography, Ranchi, p.27.

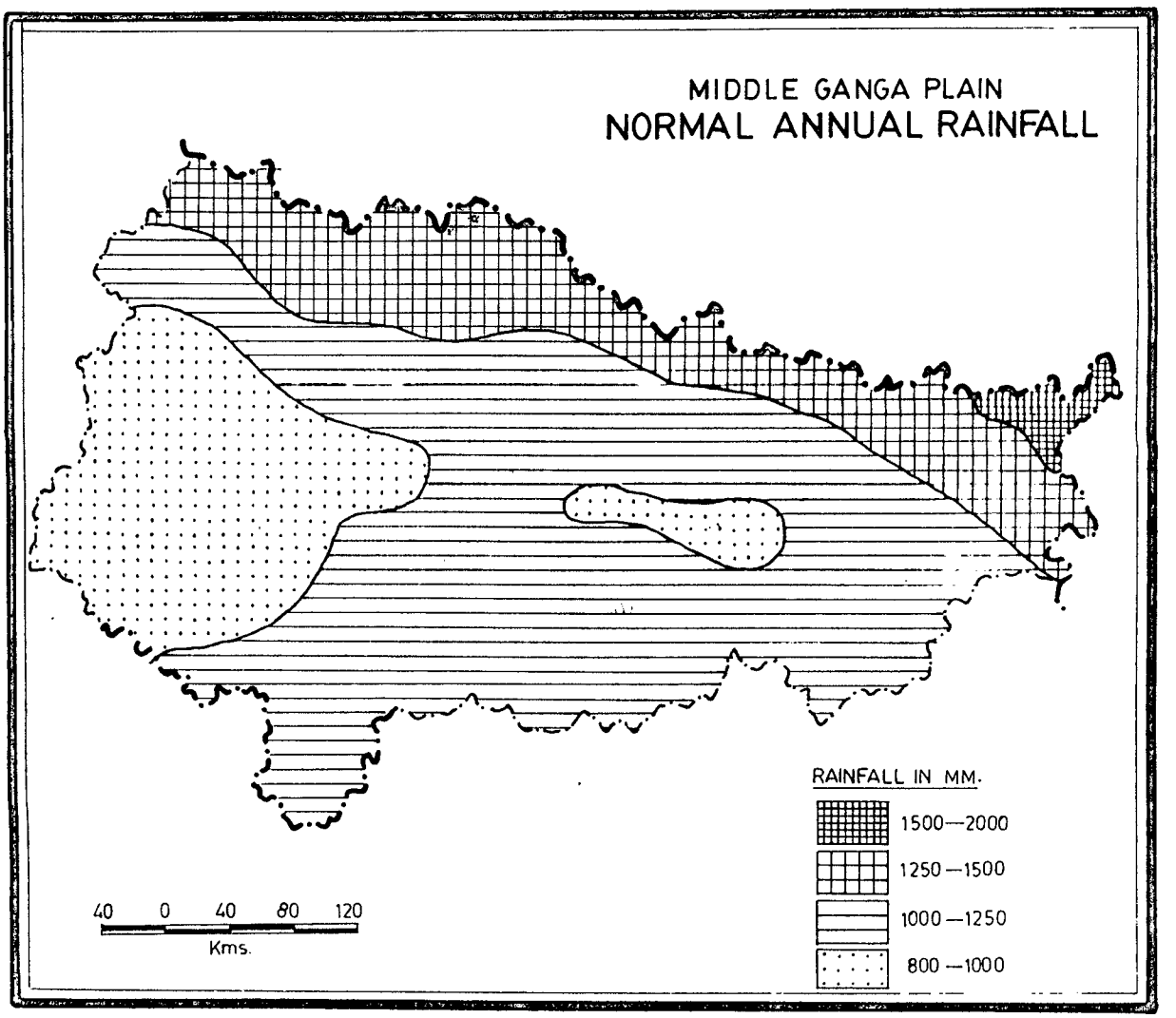
MIDDLE GANGA PLAIN
NORMAL ANNUAL RAINFALL
RAINFALL IN MM.
1500—2000
1250—1500
1000—1250
800—1000
40 0 40 80 120
Kms.

Fig. 2·5

devastation of life and property. Almost all the rivers shift their courses.

Climate: Climate is one of the most important factors governing and controlling the activities of man, natural vegetation, soils etc. The location of the Himalayas on the north and the peninsular foreland in the south and lack of physical undulations to check the sweeping winds and air currents from the east and west are responsible to make the region transitional in character. The summer heat is less intense than in the drier Upper Ganga plain and also less moist than the Lower Ganga plain. In spite of its continental interior location within the sub-tropical climatic belt, the monsoon reigns supreme here and carries great weight in the overall human occupance pattern and economic development. The rains generally start abruptly with the cloud burst of the summer monsoon. The region experiences decreasing amount of rainfall from east to west and from north to south. (See Map [illegible] and 2:5)

Soil: Almost whole of the region has broad alluvial soil cover except the undifferential soil of the Siwalik fringe zone in Champaran district. The soils in general are less developed and are distributed in relation to the alluvial cones or fans evolving in the plains. These are still largely immature and have not developed any

characteristic of soil profile or zonal differentiations, particularly in the Khadar and Bhur lands, being rejuvenated by constant deposition of sand and silt brought by numerous streams. 'The soils vary from north to south but the south-east trends of the rivers bring modifications in their distributional pattern'.[1] Since these have a common origin and almost identical ecological environment, they show generally minor variation in colour, texture, and moisture content etc., but the topographical and drainage differences have brought significant changes in soil morphology. 'They differ in texture and consistency from drift sands through rich looms and fine silts to stiff and heavy clays which are ill drained and are sometimes charged with injurious accumulation of sodium salts, producing sterile deflocculated conditions resulting in user soils'.[2] There is deficiency of nitrogen in the soil but it is rich in mineral and organic plant foods. Alluviums are divided in 'Khadar' (newer in age) and 'Bhagar' (older in age) through out the region. They remain moist and derive moisture from the rivers through seepage in dry period and are capable of growing crops without irrigation. 'Khadar' is rich for 'bhadai', 'rabi' and zied (especially

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1. Singh, R.P. and Kumar, A., Morphology of Bihar: A Geographical Study, p.27.

2. Singh, R.L., op. cit., p.203.

root) crops and sugarcane. 'Bhagar' is more suitable for rice cultivation. Another varient of the alluvial soil, which is noticed is the 'Terai' soil. This soil extends from the narrow terai zone of Chmaparan district through a 15 to 30 km. northern most strip in Deoria, Gorakhpur etc. This type of soil is highly leached heavy cleyey ones and provide moist conditions for rich rice crop. (See Map No.2:3)

Population Distribution: The region is predominantly agriculture based where more than four-fifths of the total population reside in the rural areas and depend on agriculture. As a result the population is densely agglomerated in regions which are agriculturally most favourable ones, having a high percentage of culturable lands, good rainfall or irrigation facilities and plain topography.

Agriculture being the principal occupation of the rural population in the region, the distribution of population and the agricultural value of the different tracts (which is determined by the fertility of the soil, reinfall conditions/availability of irrigation facilities and so on) are highly linked together.[1]

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1. Tiwari, A.N., Geography of Uttar Pradesh, NBT Publication, New Delhi, 1971, p.86.

Table II.1: Density of Rural Population*

Sl. No.	Name of the Districts	Population Density (Persons/km^2)
1.	Patna	498
2.	Gaya	333
3.	Shahabad	319
4.	Saran	560
5.	Champaran	363
6.	Muzaffarpur	585
7.	Darbhanga	576
8.	Munger	349
9.	Bhagalpur	330
10.	Saharsa	381
11.	Purnea	335
12.	Allahabad	330
13.	Gonda	296
14.	Faizabad	394
15.	Sultanpur	364
16.	Partapgarh	374
17.	Basti	398
18.	Gorakhpur	443
19.	Deoria	505
20.	Azamgarh	472
21.	Jaunpur	466
22.	Ballia	476
23.	Ghazipur	433
24.	Varanasi	420
25.	Mirzapur	119

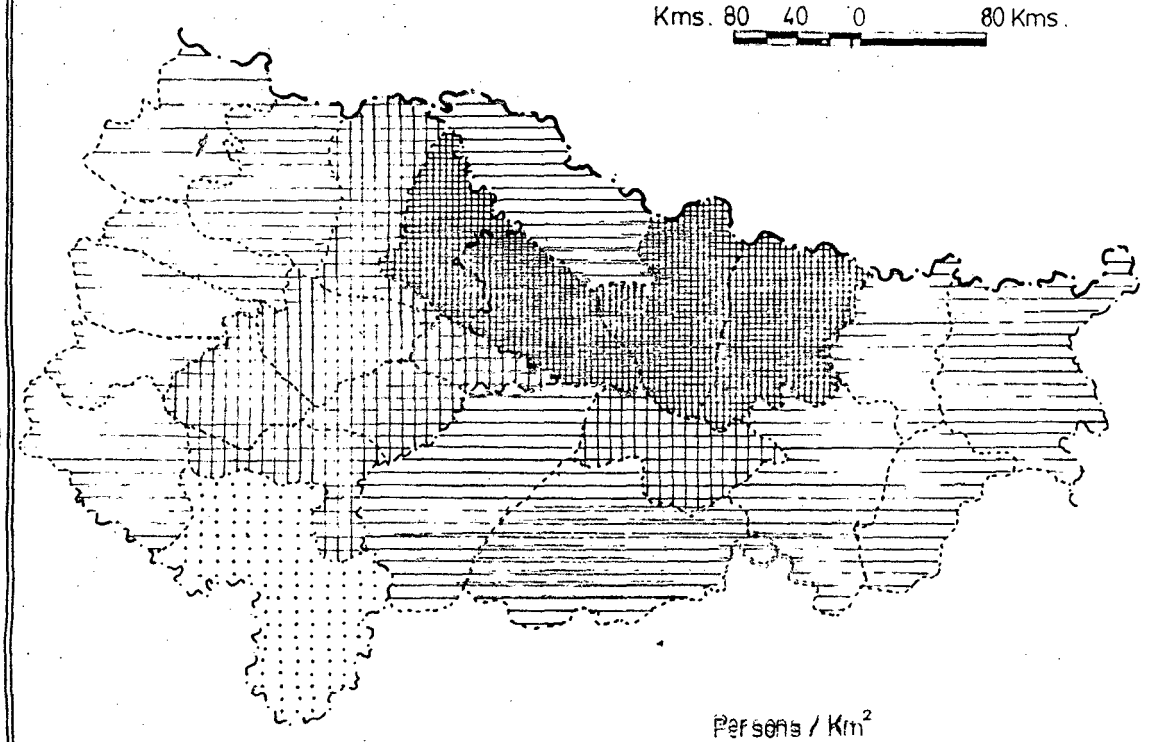
* Worked out on the basis of total Geographical area of the respective districts.

MIDDLE GANGA PLAIN

POPULATION DENSITY
(RURAL, 1971)

SCALE

Kms. 80 40 0 80 Kms.



Persons / Km^2

- 500 and above
- 400 500
- 300 400
- 200 300
- 200 and below

In the region the highest density is to be found in the districts of the Mithila plain, namely Darbhanga, Muzaffarpur and Saran, and Deoria (the only in the east U.P. plain). The density further south, east and west decreases. In the Mirzapur district, the inhospitability of topography and poor soil are the main reasons of least dense population. Gonda in the extreme north west of the region ranks second in low density. (See Map No.2:6)

Economy: The economy of the 'Middle Ganga Plain' is highly under developed and also unbalanced as it is overwhelmingly dominated by agriculture and that too of generally a subsistence type. Other sectors of the economy are yet to come up.

Agriculture, the main economic activity is dominated by food crops such as rice, gram, wheat, barley, maize, pulses etc. The only commercial crop or non-food crop which is grown in almost whole of the region is sugarcane. Jute, another commercial crop is mainly confined to the north-eastern margin of the region, in the districts lying in the Kosi plain - Purnea and Saharsa.

The availability of agricultural land* varies from one part to another and so does the net sown area.[1] Of

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* A detailed description of land use pattern has been given in Chapter V.

1. Singh, R.L., op. cit., p.

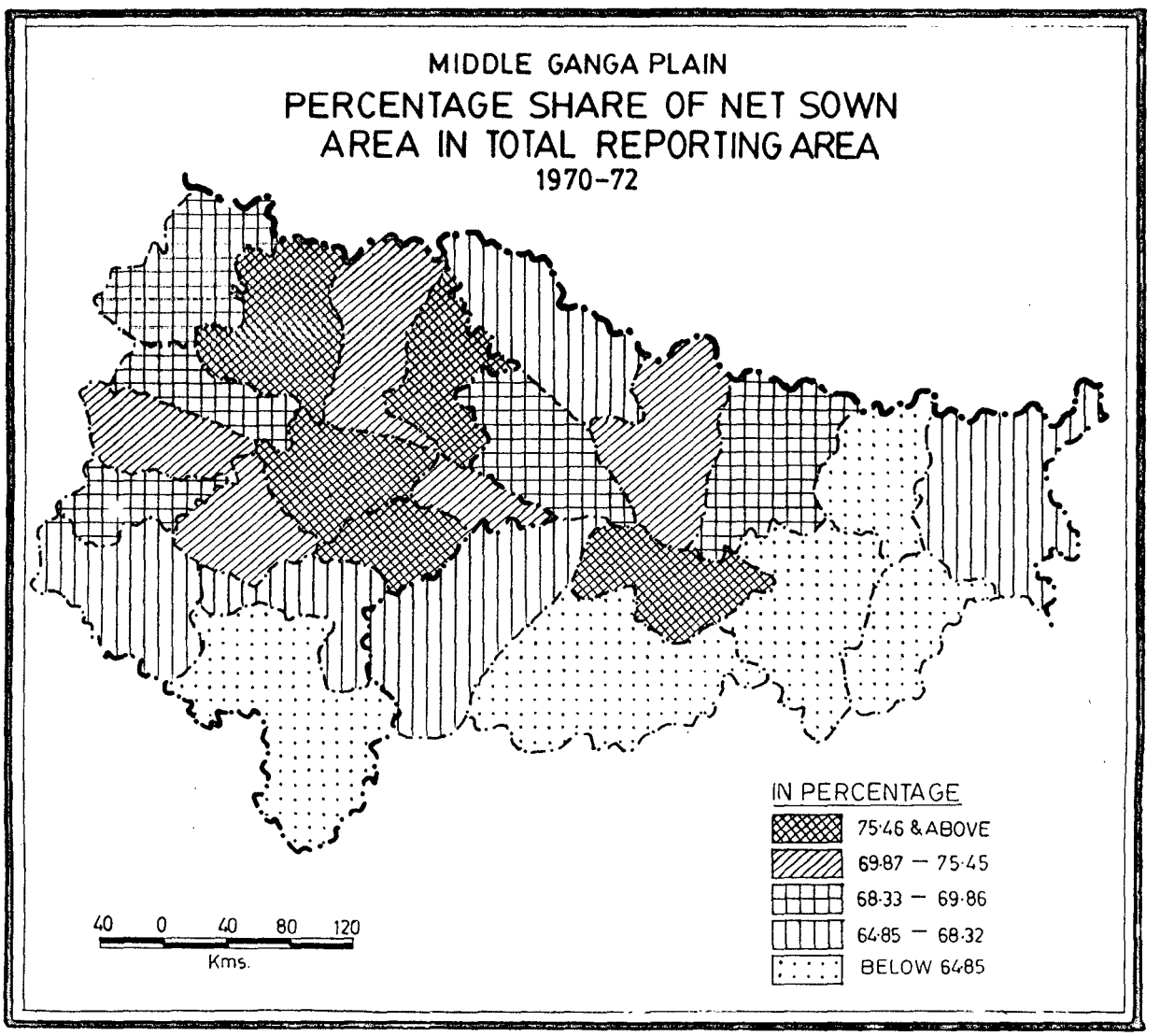
MIDDLE GANGA PLAIN
PERCENTAGE SHARE OF NET SOWN AREA IN TOTAL REPORTING AREA
1970-72
IN PERCENTAGE
75·46 & ABOVE
69·87 – 75·45
68·33 – 69·86
64·85 – 68·32
BELOW 64·85
40 0 40 80 120
Kms.

Fig. 2·7

the total reporting area for land utilisation 64.70 per cent is under net sown area. However this percentage share is higher in the east U.P. plains than in the Bihar plains - the figures being 65.70 per cent and 63.83 per cent respectively. This share displays a decreasing trend for both north to south and west to east. The highest shares are found in the districts lying in the 'Ganga-Ghaghara doab' such as Ghazipur, Azamgarh etc. and in the Saryupur plains such as Deoria and Basti. In the Mirzapur district, lowest share of total reporting area for land utilisation is found under net sown area category. In the Bihar plains, the highest share is noticed in Patna and the lowest in Munger.

With the increasing use of high yielding varieties of seeds and modern techniques of production and growing facilities for irrigation, storage and marketing and transportation some traditionally subsistence crops such as rice, wheat or maize have become money crops at least for the well to farmers.[1]

Main Crops:

In the region, two broad crop seasons can be found, (1) the kharif or the summer rainy season, during which

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1. Ibid., p.234.

Table II.2: Percentage Share of Net Area Sown in the Total Reporting area for land Utilisation (1970-72)

Districts	Share
Patna	62.15
Gaya	58.88
Shahabad	69.91
Saran	69.12
Champaran	67.65
Muzaffarpur	79.03
Darbhanga	69.37
Munger	47.98
Bhagalpur	53.03
Saharsa	58.54
Purnea	64.65
Allahabad	65.14
Gonda	69.78
Faizabad	69.06
Sultanpur	69.92
Partapgarh	68.71
Basti	76.65
Gorakhpur	74.48
Deoria	81.43
Azamgarh	76.89
Jaunpur	74.73
Ballia	74.02
Ghazipur	80.62
Varanasi	64.92
Mirzapur	28.48

crops needing more water are grown. The principal kharif crops in the region are rice, maize, sugarcane, tur, etc. (ii) the 'Rabi' or the winter season wherein crops, requiring not much water, are grown. They are wheat, barley, gram etc. etc. The fact that needs to be remembered is that the periodicity of the season often allows two and in few cases three harvests in a year.[1] Double cropping is done on 26.38 per cent of the total cultivated area.

Rice holds a dominant position in the region. It is a staple diet of the people. The second ranking crop is wheat. Rice occupies a little less than 40 per cent of the total cropped area. It is more dominant in the Bihar plains than its counterpart in the east U.P. plains. On the whole, in the Bihar plains, of the total cropped area, nearly 42.19 per cent is under rice cultivation, a slightly less than three times wheat average, the next important single crop. In the districts of Gaya and Purnea this figure is found to be above 50 per cent (50.68 per cent and 51.09 per cent). In the east U.P. plains, only 33.18 per cent of the total cropped area is used for rice cultivation, and here, wheat becomes dominant, but not very big difference is found between this and the Bihar

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1. Mamoria, C.B., Geography of India - Agricultural Geography, vol.1, Delhi, 1982, p.526.

plains in terms of its percentage share in total cropped area. In the Bihar plains it is concentrated in rich moisture retentive loam silts of north Bihar plains west of Baghmati in south Darbhanga and contiguous north Munger and the irrigated Gaya and Shahabad districts in western South Bihar plains. In the east U.P. plains, though all the districts grow wheat, largest concentration is found in the districts lying in the sugarcane plains, in the northern parts, namely Basti, Gorakhpur and Deoria.

Maize is the third largest crop followed by Barley, Gram, Tur and Ragi etc. Among the cash crops sugarcane is the most important both in terms of area and money. Area-wise it is next only to Gram.

CHAPTER III

DATA AND METHODOLOGY

In the concluding section of the first chapter, we have already discussed the main objectives of the present study. Taking the case study of the Middle Ganga Plain, a purely agricultural region, we intend to see the pattern of population growth in general and growth in agricultural workforce in particular, and what is the nature of relationship of this demographic aspects with that of the developments taken place in the agriculture. The time period taken is from. 1961 to 1971, in the case of demographic variables and 1959-62 and 1969-72 in the case of agricultural variables. The later is in such a way that it may correspond to the former one on demographic aspects. The average of three years, in the case of agricultural aspects, has been taken for both the two time points in order to reduce to a minimum the annual fluctuations in various aspects which happens to be the main characteristics of Indian agriculture.

In the following sections we shall discuss matters such as nature, type, limitations and source of the data taken for the study. The second half of this chapter a brief introduction of the methodology adopted will also be discussed.

Data Base of the Study:

Whole data taken for the present work can be put under two categories - (i) demographic, and (ii) agricultural. Here is the brief introduction about certain important aspects of both the two:

Demographic aspects: Data on the demographic aspects were mainly taken from the census volumes. The following are the demographic variables:

(i) total rural population, district-wise for 1961 and 1971,

(ii) distribution of population (rural) in broad age groups, 1961 and 1971,

(iii) size of the rural male workforce, 1961 and 1971, and

(iv) size of the male workers engaged in agriculture.

It is seen here that we are taking information only on males, while females in the rural economy take equal part in the economic activities. In fact this has been done so just to avoid the errors coming due to the conceptual and definitional change of 'workers' from 1961 to 1971 census. The concepts used for the measurement of the workforce have frequently changed from one census to another, and this results in the loss of comparability of data between two census.

Since our study is concerned with a period of ten years from 1961 to 1971, let us have a brief glance over the concepts and definition used in the two censuses. Both the censuses attempted to classify population into two broad groups: 'workers' and 'non-workers', but there were significant difference between the two in regard to the definition of worker, the reference period and the actual arrangements of the economic questions in the individual slips. While, in the 1961 census, the 'marginal workers' also were included in the category of 'workers', in the 1971 census, marginal workers were treated as 'non-workers'. Similarly the criterion of 'reference period' also varied from 1961 to 1971, for example, in the 1961 census, the reference period of 'seasonal work' was the 'last working season', whereas in the 1971 census, it was 'last year'. Similarly in the case of 'regular work' the reference period in the two censuses were respectively the 'fortnight' and the 'week' (preceding the date of enumeration).[1]

This conceptual and definitional changes have resulted in a steep fall in the proportion of workers

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1. Shrinivasan, K.N. and Raj, D., "Comparability of Data on 'Workers' in the 1961 and 1971 censuses" in Population Statistics in India (ed.) Ashish Bose and others, Vikas Pub., New Delhi, 1978, p.139.

or the workforce participation rate (WFPR) from 1961 to 1971. All the industrial categories of the workers reflect the same trend. In the case of the primary sectors, a very remarkable change is noticed in the unexpected large change in the relative numbers of cultivators and agricultural labourers. The number of agricultural labourers per 1000 cultivators increased considerably from 1961 to 1971, experienced uniformly over all the regions.[1] These effects are more strongly felt in the case of female workforce, because the definitional changes have particularly resulted in changing the economic status of women in cultivating household from those of workers in 1961 to dependent in 1971.[2] Hence the data for females will have to be entirely ignored in any analysis of the workforce participation rates over time, and the only way to obtain any meaningful comparison is to compare the male agricultural workers. We admit this a very poor alternative but the limitation has to be kept in mind.

The variables discussed above, have been taken from the 'General Population Tables' and 'Economic Tables' of

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1. Ambannavar, J.P., "Comparability of 1971 and 1961 Census Economic", ibid., p.173.

2. Bhalla, G.S. and others, "Food Growth - A District-wise Study" Report on the Second Phase of Jawaharlal Nehru University - Planning Commission Project, New Delhi, p.8.

Bihar and Uttar Pradesh for 1961 and 1971, published by the 'Census of India'.

Agricultural aspects: Any development in agriculture can be looked through, mainly, three factors namely, increase in area, improvement in crop yields and improvement in the cropping pattern. For all these three the following variables were taken:

(i) Net sown area,

(ii) Area sown more than once,

(iii) Net Irrigated area,

(iv) Consumption of fertilisers,

(v) Total area under various crops,

(vi) Output of crops.

The number of crops included is only eight - rice, wheat, ragi, barley (all in the cereal crops), Gram and tur (in pulses) and sugarcane (as cash crop) - the reason being, only those crops have been included which are grown over almost the whole of the region. Even though, the region is completely homogenous, there is some change in the type of crops grown from one part to another, for example, in the north-eastern extreme, jute is a very popular cash crop due to favourable geographical factors, it is not at all seen in the western counterpart. Similarly, in the east U.P. plains, several pulses are

grown which are not so popular in the eastern part of the Bihar plains. These eight crops alone cover more than two-thirds of the 'Gross Cropped Area' (GCA) in the region.

The district-wise average figures for net area sown, area sown more than once, total cropped area, net area under irrigation etc. etc. were obtained from the 'Indian Agricultural Statistics' published by the 'Directorate of Economics and Statistics, Ministry of Agriculture. Informations such as area under different crops, their output were obtained from the 'Agricultural Situation in India' published by the 'Ministry of Food and Agriculture, New Delhi'. Data on the consumption of Chemical Fertilizers (NKP) have been obtained from 'Fertiliser Statistics' published by the 'Fertiliser Association of India', New Delhi.

It is worthwhile to point that no adjustments for changes in the district boundaries have been made. Not all the data taken in this study have been obtained from the above discussed two sources. Apart from these two sources, there are other sources, too, for some of the specific variables included in the present work. The district-wise figures of land and labour productivity in terms of money value per hectare and per workers were obtained from the report on 'Food Grains Growth: A

districtwise study', a joint work of Jawaharlal Nehru University and Planning Commission, New Delhi. These figures correspond to the periods 1962-65 and 1970-73. These money values were obtained for nineteen crops in the project by applying the average all India constant 1970-73 prices for both the periods. The money value for all the crops has been given in Appendix .

The data on agricultural growth rates for the period 1962-65 to 1970-73 were obtained from - 'Country Monography Series No.10, Population of India, ESCAP, United Nations New York, 1982.

METHODOLOGY:

The main objective of the present study is to establish the relationship between population and agricultural variables. It should be pointed out that it is very difficult to determine which set of variables is cause and which set of variables effect, but it is sure that there exists a sort of bi-directional relationship. Hence we have confined the study to the coefficient correlation[1] between different variables. The coefficient correlation can be defined as

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1. For detailed description on Coefficient Correlation, please see A. Mahmood, Statistical Methods in Geographical Studies, New Delhi, 1986, pp.49-60.

$$r = \frac{\Sigma XY - \frac{\Sigma X \Sigma Y}{N}}{\sqrt{\Sigma X^2 - \frac{(\Sigma X)^2}{N}} \sqrt{\Sigma Y^2 - \frac{(\Sigma Y)^2}{N}}}$$

Where X and Y are two variables between which the correlation has to be worked out, and N is the number of observations.

The value of r varies between -1 and +1 depicting maximum negative and positive correlation. When r is equal to '0' or 'very close to it it shows that the correlation is very weak.

Test of significance has also been worked out. This has been worked out at 1%, 5% and 10% levels of significance. The formula is

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

Where 'n' is the number of observations used and r is the coefficient of correlation.

CHAPTER IV

CHANGES IN DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS OF THE POPULATION

Population Growth:

According to the 1961 census, the Middle Ganga Plain recorded a population of around 62 million. During the period 1961-71, about 12 million people were added in the total population, which comes to around 19.37 per cent. The overall growth rate of Bihar and Uttar Pradesh during the same period was 21.33 per cent and 19.78 per cent respectively.

In the year 1961, it was found that rural population constituted near about 92.54 per cent of the total population. This percentage share declined very marginally during the decade and in 1971, it became around 90.0 per cent. During this decade, the growth rate in the rural population was reported to be around 18.49 per cent, and with this rate, the rural population rose from 57.03 million in 1961 to 67.58 million in 1971. As against this the rural population of Bihar and Uttar Pradesh increased at the rates of 19.25 per cent and 18.20 per cent respectively. Even if, this rate of growth does not show any considerable difference from these two states of which this plain form a part, but yet one may say that this

tremendous population share and growth of rural population pose a very serious problem particularly when we place the staggering population load against the purely agrarian and underdeveloped regional economy.

Despite the fact that the region presents a sort of complete homogeneity in various aspects such as physiography or terrain, climate, soil, economy etc., a wide range of variation in the pattern of growth in the rural population growth can be noticed from one part of the region to another. Table IV.1 gives the growth rates of each of the twenty five districts included in the region.

The table shows that there are nine districts which recorded higher growth rates than the average of the whole region and around two-thirds of these are found in the Bihar plains. These districts are Gaya, Shahabad, Saran, Bhagalpur, Saharsa and Purnea (all in the Bihar plains), and Allahabad, Varanasi and Mirzapur (in the U.P. plains). On an average the districts in the Bihar plains record higher growth rates than their counterparts in the Uttar Pradesh plains - the figures being 20.15 per cent and 16.33 per cent respectively. The growth rates vary from 35.48 per cent at one extreme to only 10.14 per cent at another, a gap of slightly less than 25 per cent.

Map 4:1 gives a more detailed picture of the spatial variation in the growth of rural population. One striking

Table IV.1: Growth in the Rural Population 1961-71

Districts	Population 1961	Population 1971	Decadal Variation	% of Growth
Patna	2355850	2755152	399302	16.95
Gaya	3382794	4117468	734674	21.72
Shahabad	2986316	3615151	628835	21.06
Saran	3435002	4099721	664719	19.35
Champaran	2860566	3358392	497826	17.40
Muzaffarpur	3929573	4586719	657146	16.72
Darbhanga	4222472	5001908	779436	18.46
Munger	3011883	3430544	418661	13.90
Bhagalpur	1524417	1869235	344818	22.62
Saharsa	1656139	2243793	587654	35.48
Purnea	2903531	3691819	788288	27.15
Allahabad	1994412	2395175	400763	20.09
Gonda	1971981	2171913	199932	10.14
Faizabad	1491572	1743099	251527	16.86
Sultanpur	1386903	1610598	223695	16.13
Partapgarh	1230799	1394798	163999	13.32
Basti	2588658	2908791	320133	12.37
Gorakhpur	2377839	2798019	420180	17.67
Deoria	2317498	2729241	411743	17.77
Azamgarh	2292879	2708617	415738	18.13
Jaunpur	1635039	1880672	245033	14.98
Ballia	1285622	1516175	240553	17.93
Ghazipur	1276424	1462654	186230	14.59
Varanasi	1809033	2135665	326652	18.57
Mirzapur	1105926	1355703	249777	22.59
Region	57033928	67581242	10547314	18.49

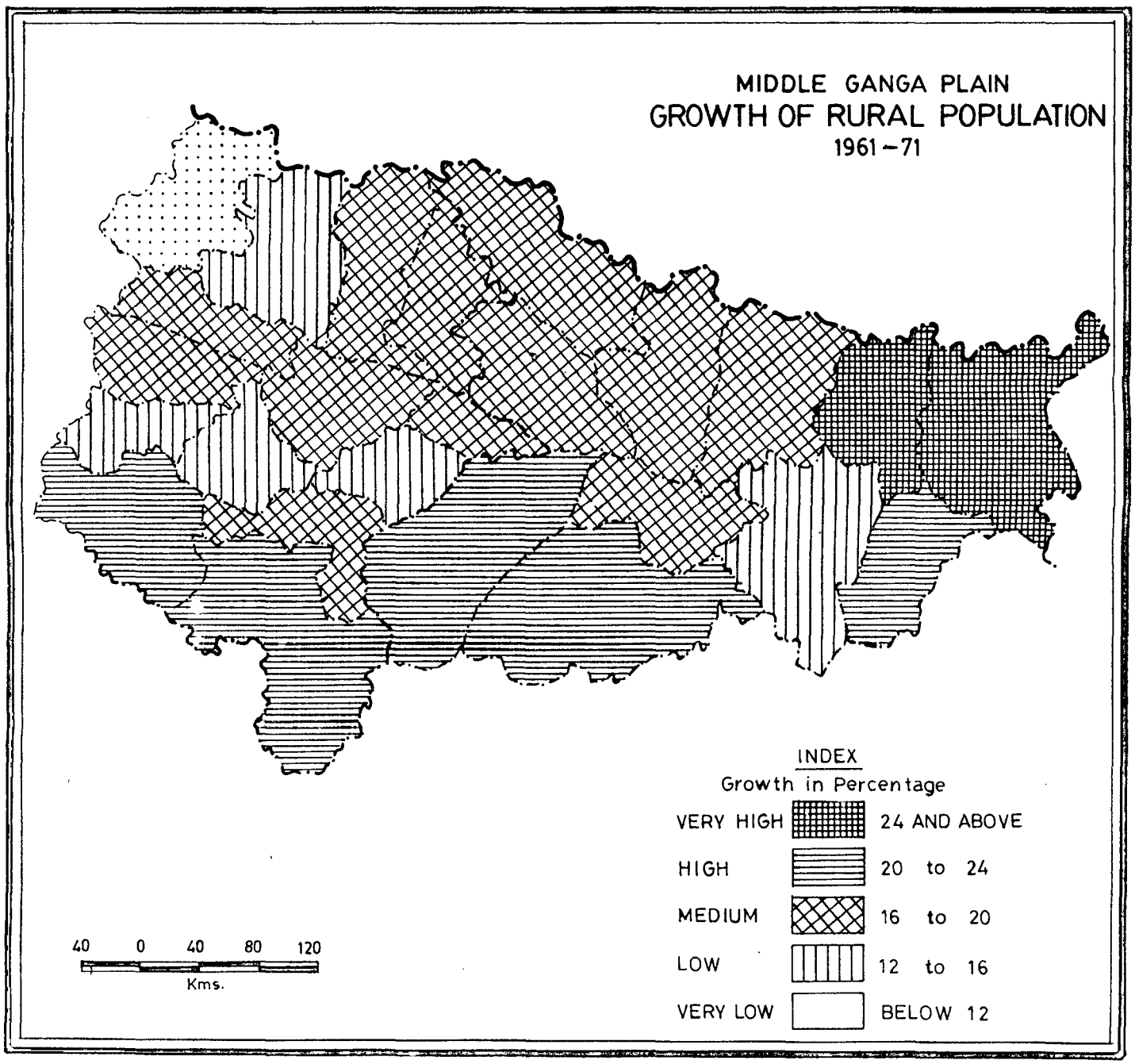
MIDDLE GANGA PLAIN
GROWTH OF RURAL POPULATION
1961 – 71
INDEX
Growth in Percentage
VERY HIGH 24 AND ABOVE
HIGH 20 to 24
MEDIUM 16 to 20
LOW 12 to 16
VERY LOW BELOW 12
40 0 40 80 120
Kms.

Fig. 41

feature emerges out of the map that except some interruptions, the growth rates generally tend to decline towards both west and north. The districts in the eastern, south-eastern and southern parts form a belt of high rate of increase. The lowest rate is reported in the extreme western part, in the district of Gonda.

Saharsa, in the Kosi plain, recorded the highest rate of growth of rural population which is 35.48 per cent. The adjoining district, Purnea, ranks second with a rate of 27.15 per cent. The other districts, forming almost a crescent in the south are Bhagalpur, Gaya, Shahabad (all in Bihar), Mirzapur and Allahabad (in U.P.).

The next category of growth rate varying from 16 to 20 per cent, here termed as the category of medium growth rate, comprises the largest number of districts. Saran, Champaran, Muzaffarpur, Darbhanga all in the Mithila plain and Patna (in the south of Ganga), form a contiguous group, the highest growth being in the case of Saran, in the north west of Mithila plain. The districts in the U.P. plain, under this category, also form a contiguous group, except Varanasi which is separated from the rest by Ghazipur and Jaunpur districts of low growth rates. The districts in the category of medium growth are Faizabad, Sultanpur, Azamgarh, Deoria, Gorakhpur and Varanasi.

Table IV.1a: Population Concentration 1961

(Gini's Coefficient)
G = 0.162

Districts	Cumulative Percentage of Population X	Cumulative Percentage of Area Y	XiYi+1	Xi+1Yi
Mirzapur	1.94	6.52	25.34	46.81
Shahebad	7.18	13.06	139.44	160.25
Purnea	12.27	19.42	290.31	305.28
Gonda	15.72	23.66	423.18	435.34
Bhagalpur	18.40	26.92	574.42	589.28
Allahabad	21.89	31.11	837.07	865.48
Gaya	27.82	36.24	1158.42	1175.12
Saharsa	30.73	41.64	1453.84	1499.46
Munger	36.01	47.31	1894.85	1940.18
Champaran	41.02	52.62	2263.48	2286.87
Sultanpur	43.46	55.18	2491.56	2516.76
Partapgarh	45.61	57.33	2731.58	2765.03
Faizabad	48.23	59.89	3092.02	3160.40
Basti	52.77	64.11	3538.23	3586.31
Varanasi	55.94	67.05	3954.96	4030.38
Gorakhpur	60.11	70.70	4356.99	4408.15
Ghazipur	62.35	72.65	4736.73	4821.78
Azamgarh	66.37	75.97	5163.59	5213.06
Ballia	68.62	77.80	5499.21	5561.92
Jaunpur	71.49	80.14	5957.26	6060.19
Patna	75.62	83.33	6537.35	6639.73
Deoria	79.68	86.45	7287.53	7528.93
Darbhanga	87.09	91.46	8314.48	8515.84
Saran	93.11	95.47	9311.00	9547.00
Muzaffarpur	100.00	100.00		
Total			82042.84	83659.55

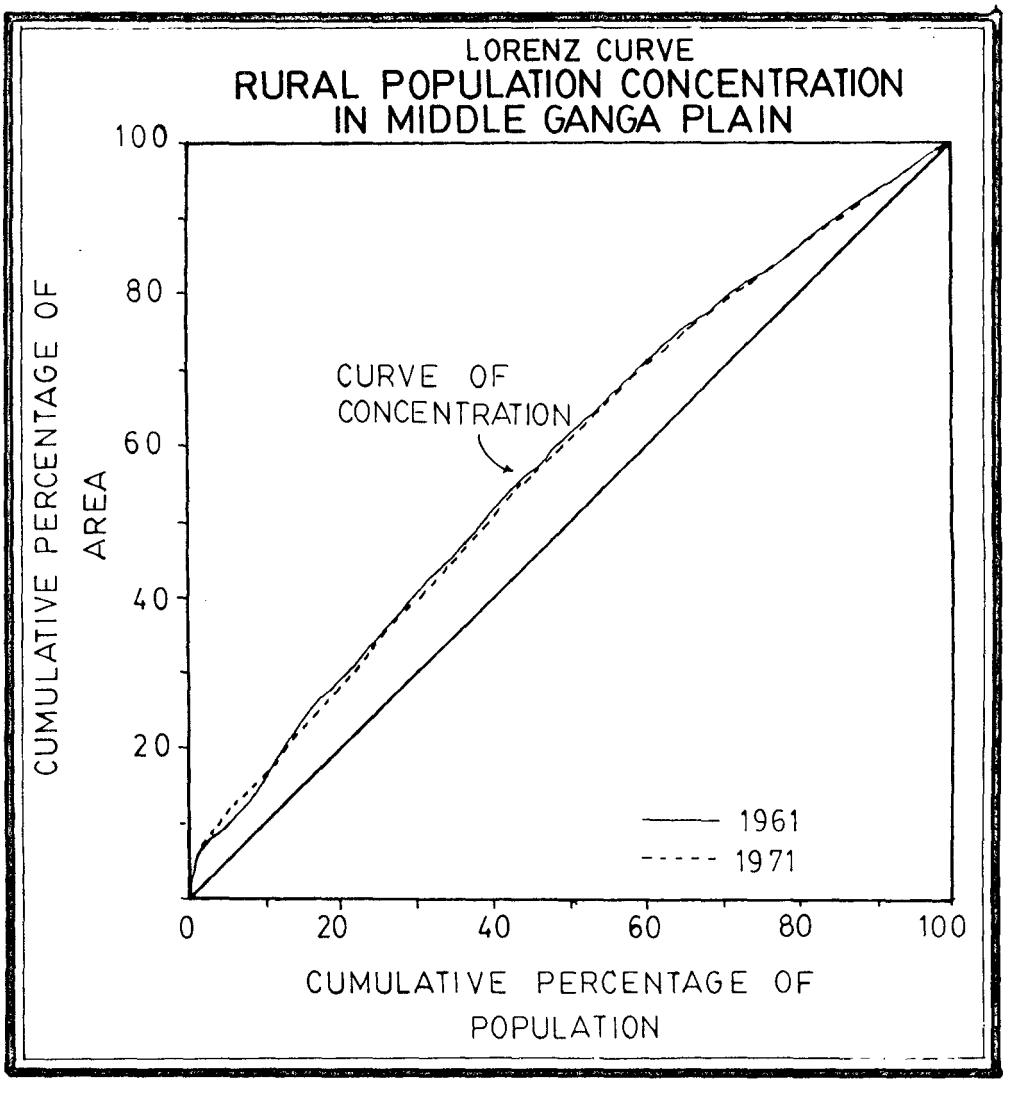
LORENZ CURVE
RURAL POPULATION CONCENTRATION
IN MIDDLE GANGA PLAIN
CUMULATIVE PERCENTAGE OF AREA
100
80
60
40
20
CURVE OF CONCENTRATION
1961
1971
0
20
40
60
80
100
CUMULATIVE PERCENTAGE OF POPULATION

Fig. 4.2

Table IV.1b: Population Concentration, 1971

(Gini's Coefficient)
G = 0.156

Districts	Cumulative percentage of Population X	Cumulative percentage of Area Y	XiYi+1	Xi+1Yi
Mirzapur	2.01	6.53	21.63	34.09
Gonda	5.22	10.76	90.31	113.73
Shahabad	10.57	17.30	217.32	230.61
Bhagalpur	13.33	20.56	329.92	347.05
Allahabad	16.88	24.75	538.13	568.51
Gaya	22.97	31.88	878.37	906.35
Purnea	28.43	38.24	1248.65	1281.42
Munger	33.51	43.92	1557.21	1576.29
Sultanpur	35.89	46.47	1858.38	1898.76
Champaran	40.86	51.78	2203.58	2222.92
Partapgarh	42.93	53.93	2461.18	2494.26
Saharsa	46.25	57.33	2769.91	2799.42
Faizabad	48.83	59.89	3130.49	3181.96
Basti	53.13	64.11	3562.37	3608.75
Varanasi	56.29	67.05	3884.01	3919.74
Ghazipur	58.46	69.00	4247.12	4319.40
Gorakhpur	62.60	72.65	4693.75	4749.86
Jaunpur	65.38	74.98	5119.25	5202.86
Azamgarh	69.39	78.30	5560.91	5608.63
Ballia	71.63	80.14	5968.93	6067.40
Patna	75.71	81.33	6545.13	6645.57
Deoria	79.75	86.45	7214.19	7418.27
Saran	85.81	90.46	8192.28	8431.78
Darbhanga	93.21	95.47	9321.00	9547.00
Muzaffarpur	100.00	100.00		
Total			81614.02	83174.63

The districts recording low growth rates between 12 and 16 per cent are Basti, in the north of the U.P. plains and Partapgarh, Jaunpur and Ghazipur in the centre and Munger in the Bihar plains. Gonda in the extreme north-west of the region reported the lowest growth in the rural population, a rate of merely 10.14 per cent.

Though, there has been considerable amount of spatial variation in the pattern of growth in the rural population, the geographical distribution has not experienced much change during the decade 1961-71. Diagram No.4:2, the Lorenz Curve, shows that the inequalities in the spatial distribution of rural population has not further accentuated. Whatever inequalities were found in 1961 has been maintained at more or less the same level in 1971 also. The values of Gini's Coefficient for 1961 and 1971 separately, being 0.162 and 0.156 respectively, too, indicate that the inequalities are not very high and that it has not changed very considerably. There has been a slight decrease in the spatial concentration of population.

There are three basic components of population growth - namely fertility, mortality and migration. The data on fertility and mortality are not at all reliable, hence[1]

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1. Premi, M.K. and others, Introduction to Social Demography, New Delhi, 1983, p.81.

Table IV.2: Dependency Ratio - 1961 & 1971
(Male Population)

Districts	Dependency Ratio 1961	Dependency Ratio 1971	Decadal Change
Patna	97.19	100.74	3.55
Gaya	100.25	104.71	4.46
Shahabad	90.02	103.38	5.38
Saran	119.67	115.91	-3.76
Champaran	88.02	89.86	1.84
Muzaffarpur	103.22	100.87	-2.35
Darbhanga	102.61	96.49	-6.12
Munger	99.77	97.68	-2.09
Bhagalpur	97.16	100.43	3.27
Saharsa	99.37	96.25	-3.12
Purnea	93.54	102.82	9.28
Allahabad	93.67	104.88	11.21
Gonda	84.21	85.11	0.90
Faizabad	94.65	99.55	4.90
Sultanpur	96.19	101.56	5.37
Partapgarh	105.80	114.35	8.55
Basti	86.14	89.48	3.34
Gorakhpur	92.39	95.11	2.72
Deoria	97.46	100.59	3.13
Azamgarh	110.57	112.43	1.86
Jaunpur	112.39	113.89	1.50
Ballia	110.71	97.97	-12.74
Ghazipur	111.82	117.46	5.64
Varanasi	100.46	100.60	0.14
Mirzapur	87.26	102.31	15.05
Region	99.15	100.94	1.79

it is quite pointless to discuss the courses of these factors to understand the pattern of growth. The third component - migration - can further be divided into two parts - immigration and outmigration. While the data on the former one (districtwise) can be obtained from the census, the same for outmigration is not available on district level. Hence, the combined effect of in and outmigration cannot be assessed in the overall growth of population.

Since the region is fairly homogeneous in terms of socio-economic and other determinants of natural rate of growth, the differentials in fertility and mortality is also expected to be homogeneous over the region with certain limitations. The region is characteristically an out migrating area,[1] we shall try to assess the effects of net migration (if it is there) through the changing dependency ratios. In fact in such regions, the scarcity of arable lands and dearth of employment opportunities in the non-agricultural activities generate a 'push factor' in the rural areas. People outmigrate to the surrounding

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1. Gupta, P. Sen, "Formation of Economic Regions by Population Characteristics and Resource Development" in Galina, S. and Gupta, P.S. (eds.), Economic Regionalisation of India, Census of India Monograph, 1968, New Delhi, p.99.

urban places as well as to the other big cities outside the region, which directly affects the overall growth of population. These spatial movements are usually predominantly age-selective in nature which increases the dependency burden of the population at the place of origin. Keeping this assumption in mind, let us have a look at the Table IV.2 which gives the dependency ratios and changes therein for the periods 1961 and 1971.

The region experienced an increase in the dependency burden from 99.15 in 1961 to 100.94 in 1971. The district wise figures again show a large amount of subregional variations in the changes. While on the one hand there are some districts which have recorded a considerable fall in the dependency burden, there are many districts on the other hand which reported serious increase in the dependency burden. Saran, Muzaffapur, Darbhanga, Munger, Bhagalpur, Ballia and Ghazipur have also recorded decline, the largest fall being in the case of Ballia, where it fell from 110.71, in 1961, to 97.97, in 1971. All the other districts showed increase during these ten years. There are five districts which showed very marginal increase in the dependency ratio. These are Champaran, Gonda, Azamgarh, Jaunpur, and Varanasi. Allahabad and Mirzapur recorded very high increase. In the category

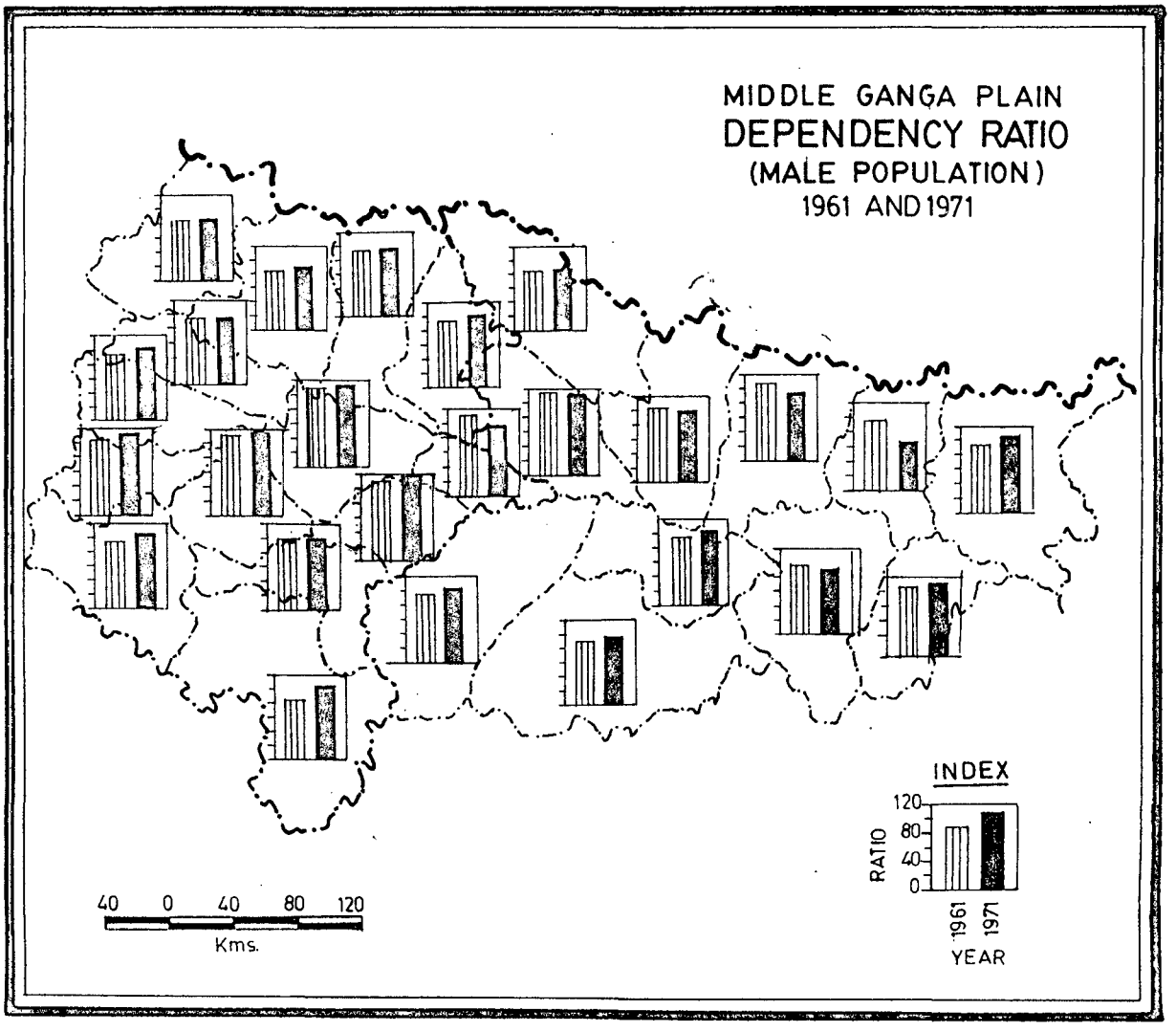
MIDDLE GANGA PLAIN
DEPENDENCY RATIO
(MALE POPULATION)
1961 AND 1971
INDEX
120
80
40
0
RATIO
1961
1971
YEAR
40 0 40 80 120
Kms.

Fig. 4.2a

of medium increase Shahabad, Purnea, Sultanpur and Partapgarh may be included. All the rest of the districts, numbering around seven showed very low increase. There are six districts which showed dependency burden higher than the average for the whole region both in 1961 and 1971. They are: Gaya, Saran, Partapgarh, Azamgarh, Jaunpur and Ghazipur. (See Map No.4:2)a.)

He assumed that the low rate of growth in rural population in some of the districts was due to outmigration of people. This is a valid assumption because the courses of fertility and mortality can't be so drastically different in these districts than the ones where the rate of growth has been larger. Had the outward movements of people from these districts been age-selective, as is generally found in most of the cases, the dependency ratio would have equally shown an increasing trend. But in the case of Gonda and Basti which recorded lowest growth, the dependency ratio has very marginally increased. This leads one to assume that migration has been there but not age-selective in nature. Children below the age of fifteen years, too, must have migrated to the surrounding urban areas as child labour which is not an uncommon phenomenon. In the districts where both the growth rate and dependency ratio is larger, the high fertility and low rate of mortality must have

resulted in increase of dependency ratio between 1961 and 1971. The districts of Ballia, Ghazipur, Saran, Champaran, Muzaffarpur, Darbhanga, Bhagalpur, Munger etc. have recorded some amount of decline in the dependency burden. It is seen that these are the districts where we noticed medium growth in the population, varying between 16 to 20 per cent. To some extent the incoming population in the working age groups may be held responsible for decline in the dependency burden.

Economic Characteristics:

Economic characteristics of a population are equally important to be dealt with. From the very beginning of man's emergence on the earth, work and production have been the part and parcel of his life. Since his emergence itself, man has to exert himself to satisfy his needs as well as the requirements of the society.

However, only a part of the total population is found to be engaged in economic activities. The size of this economically engaged population - 'labour force' - and its proportion to the total population are considered to be the best indicators of the level of economy and the per capita income. Apart from this, the occupational structure of workforce, i.e. its distribution among various sectors of economy is also having an evident

bearing on the productive capacity and economic growth of a country. With the process of economic development, a population experiences shift of workers from primary to secondary or tertiary sectors. In fact the occupational structure of labour force of any population reveals just the stage of economic growth it has achieved. Here in the proceeding sections we will see the changes taken place in the work participation rate, growth in the labour force as a whole and in agricultural workers separately, and finally the share of agricultural workers in the total workforce. It should be kept in mind that all these relate to male workforce only.

Workforce Participation Rate: In the year 1961, male workforce participation rate for the region as a whole was 59.21. Over the period of ten years from 1961 to 1971 this rate came down to 55.21, a fall by nearly 4 per cent. The workforce participation rates for males in Bihar and Uttar Pradesh were 55.99 and 59.20 in 1961, and 52.73 and 52.98 in 1971, respectively. It is noted that at all levels, the work participation has declined. Even for India a whole, the work participation rate has shown a secular decline. It should be pointed out here that this fall cannot be attributed entirely to the observed secular trend; a major part of it seems to be

Table IV.3: Male workforce participation rates for 1961 and 1971 and growth in the workforce 1961-71

Districts	Workforce Participation rates		Growth in workforce 1961-71
	1961	1971	
Patna	53.07	49.89	12.14
Gaya	54.25	50.56	15.90
Shahabad	53.51	49.00	13.44
Saran	49.78	47.65	19.25
Champaran	58.64	56.37	15.75
Muzaffarpur	54.53	53.79	18.81
Darbhanga	53.78	53.21	21.91
Munger	53.20	52.52	11.49
Bhagalpur	53.05	52.15	16.54
Saharsa	57.19	55.44	33.08
Purnea	58.82	56.27	22.13
Allahabad	56.89	51.03	6.25
Gonda	63.67	60.11	7.26
Faizabad	59.12	53.45	8.86
Sultanpur	58.52	52.39	6.50
Partapgarh	56.06	49.12	1.63
Basti	62.46	57.81	6.46
Gorakhpur	58.69	53.29	10.35
Deoria	57.21	51.94	9.32
Azamgarh	54.32	47.69	8.62
Jaunpur	53.60	46.39	1.61
Ballia	52.98	46.63	7.15
Ghazipur	53.84	48.10	4.56
Varanasi	54.38	48.49	8.34
Mirzapur	59.85	52.88	10.04

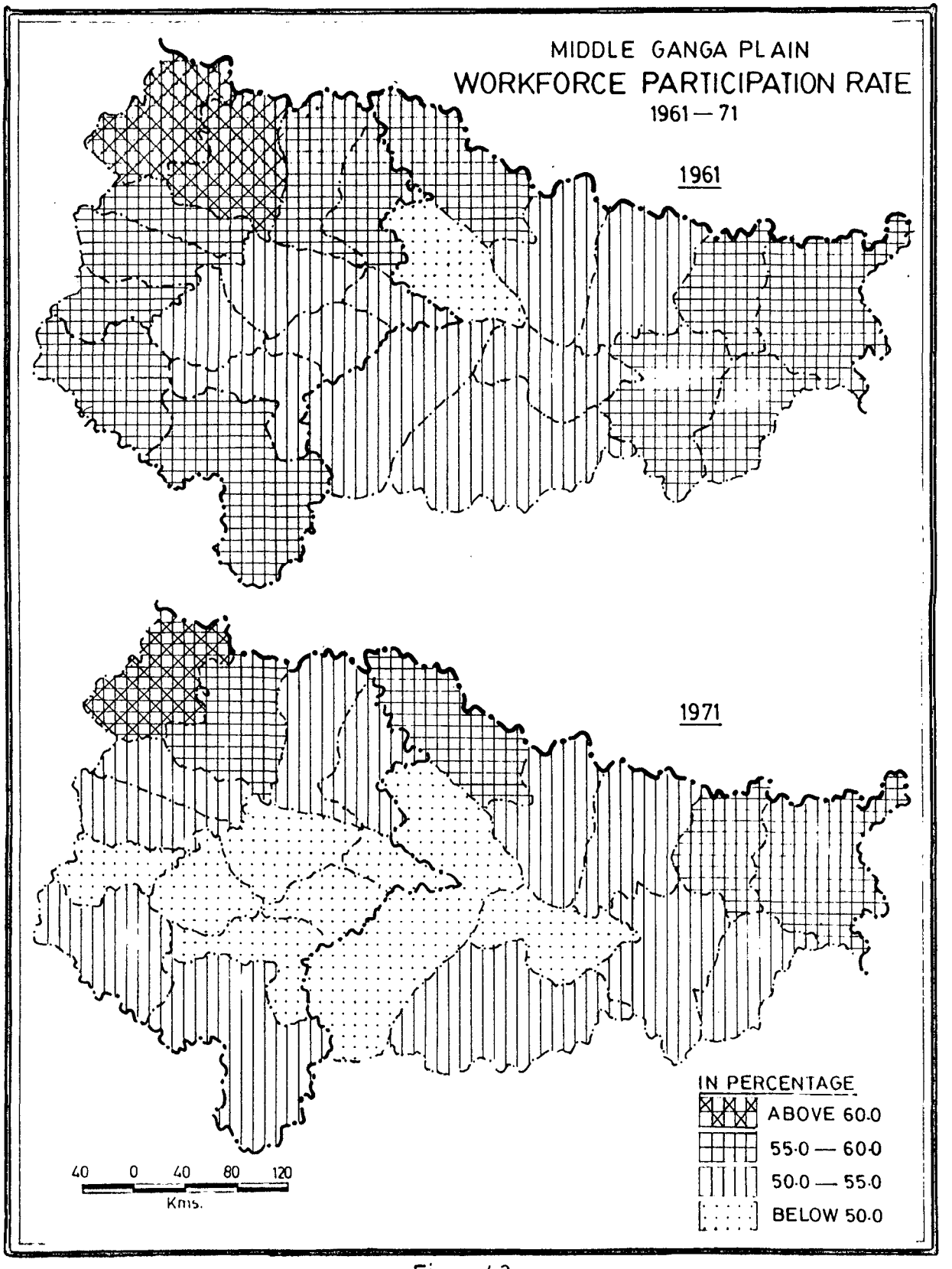
MIDDLE GANGA PLAIN
WORKFORCE PARTICIPATION RATE
1961 — 71
1961
1971
IN PERCENTAGE
ABOVE 60.0
55.0 — 60.0
50.0 — 55.0
BELOW 50.0
40 0 40 80 120
Kms.

Fig. 4.3

the result of changes in definition.[1]

Table IV.3 giving the district level information on work participation rates indicates that in all the districts, there has been decline in the share of workforce in the total population. However, this decline shows a large variation over space. On the one hand there are districts which has recorded a very small decline in the share, by even less than one per cent, on the other hand, some districts, for example, Allahabad, have shown a marked decline in the work participation rate. Another remarkable thing which we notice, is the fact that, on the whole the Bihar plain showed comparatively smaller decline than that of the U.P. plains.

In fact this work participation rate over time is the function of the growth rates of both population as a whole and workforce, assuming that the definition of worker does not change. In this ideal case work participation rate responds in three ways:

(i) It remains same, if the rates of change in population and workforce are equal;

(ii) It increases, when the rate of growth of the size of workforce is greater than the rate of increase in the overall population; and

(iii) It tends to decline, when the rate of growth of total population is greater than that of the size of workforce.

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1. Premi, M.K. and others, op. cit., p.57.

It is here that the study of the growth of the size of the workforce becomes important. We have already seen the growth pattern of the population in the preceding chapter.

Growth of Workforce: Now for the growth pattern of the workforce at the district level, let us have a glance again at the Table IV.3.

It is evident from the table that there is a wide sub-regional variation in the pattern of growth of the size of the workforce. During the period, from 1961 to 1971, the average growth rate in the workers' population for the region was around 13.03 per cent. The average growth rate for Bihar and Uttar Pradesh were 14.61 per cent and 7.75 per cent respectively. The same trend is noticed when the figures, for districts lying in Bihar plains and Uttar Pradesh plains, are analysed. On the whole the former recorded a very high rate of growth in the male workers, during 1961-71. All the districts lying the Bihar plains, except one, Purnea, which showed a growth rate of 11.49 per cent, experienced growth rates higher than that of the average of the region. The highest growth was shown by Saharsa district, the rate being 33.08 per cent. It may be recalled that it

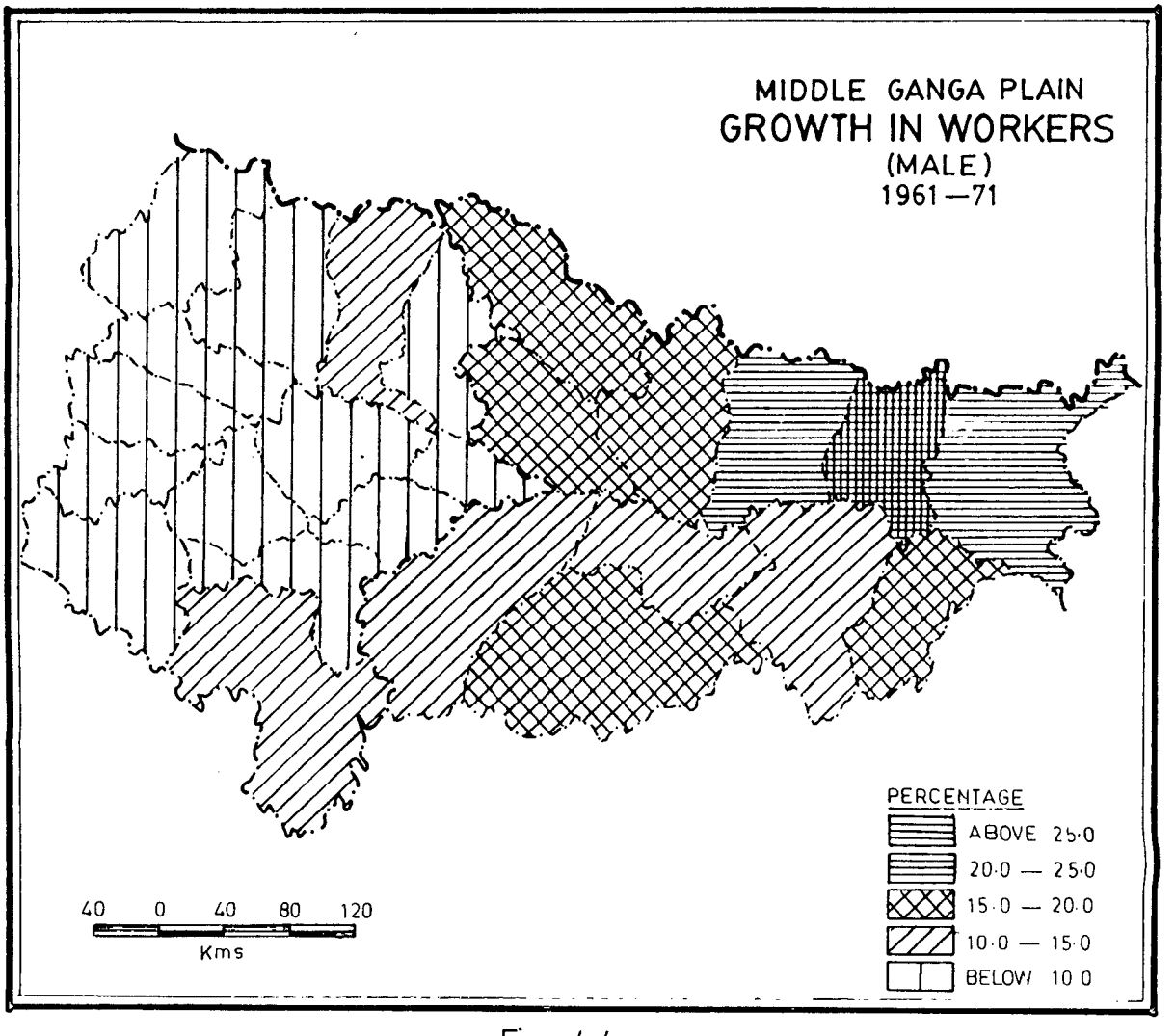

MIDDLE GANGA PLAIN
GROWTH IN WORKERS
(MALE)
1961—71
PERCENTAGE
ABOVE 25·0
20·0 — 25·0
15·0 — 20·0
10·0 — 15·0
BELOW 10·0
40 0 40 80 120
Kms

Fig. 4.4

was Saharsa where we found phenomenal growth in population. The next in the rank was Saran which recorded a growth by a rate of 19.26 per cent.

As against these, the western half of the plain, the districts of the east U.P. plains, the growth rate barely exceeded 10 per cent, except two districts. These two districts - Gorakhpur and Mirzapur - showed growth rates of 10.35 per cent and 10.04 per cent only. The smallest growth rate is seen in the district of Jaunpur (1.61 per cent). See fig. 4.4.

When the share contributed by the Bihar plains in the net addition to the size of workforce is seen, it is found that it constituted 75.96 per cent, while its share in the net addition to the total rural population is only 58.16 per cent.

Agricultural Workforce: The region is predominantly agricultural. In the year 1961, the percentage share of agricultural workers was 82.34 per cent, which further increased in 1971, when around 88 per cent of the total workers was engaged in agricultural sector. It is a matter of great concern that despite this voluminous and increasing pressure on land, there has not been any notable progress in agriculture. Since the other

Table IV.4: (i) Percentage share of Agricultural workers to the total workforce, & (ii) Growth of Agricultural workers during 1961-71

Districts	Percentage share 1961	Percentage share 1971	Growth
Patna	68.80	85.28	38.93
Gaya	81.63	87.08	23.64
Shahabad	74.90	84.22	27.56
Saran	84.14	89.09	26.28
Champaran	87.05	91.73	21.98
Muzaffarpur	85.09	90.54	26.42
Darbhanga	82.09	89.81	33.29
Munger	82.14	87.26	25.60
Bhagalpur	76.85	87.09	37.63
Saharsa	73.57	91.04	50.15
Purnea	80.69	88.96	38.39
Allahabad	80.92	83.81	10.03
Gonda	89.74	93.15	11.33
Faizabad	87.60	89.13	10.75
Sultanpur	85.73	88.93	9.19
Partapgarh	85.73	87.73	4.00
Basti	91.12	91.67	7.11
Gorakhpur	87.94	88.83	11.46
Deoria	91.61	90.59	8.10
Azamgarh	84.95	86.87	7.76
Jaunpur	85.50	87.21	3.64
Ballia	78.40	84.03	14.85
Ghazipur	79.86	84.12	10.13
Varanasi	70.39	73.25	12.74
Mirzapur	77.10	85.93	22.66

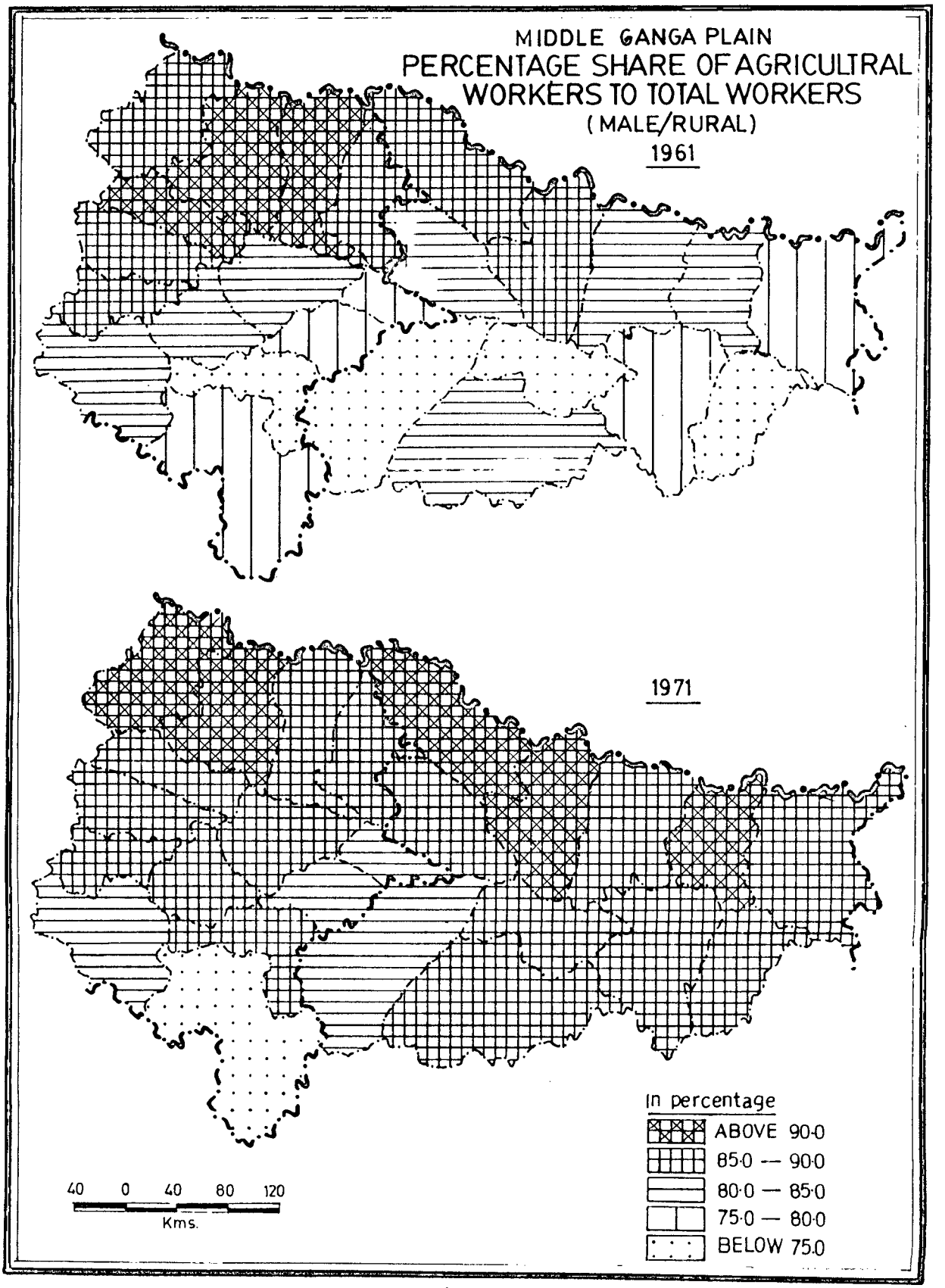

MIDDLE GANGA PLAIN
PERCENTAGE SHARE OF AGRICULTRAL WORKERS TO TOTAL WORKERS
(MALE/RURAL)
1961
1971
In percentage
ABOVE 90·0
85·0 — 90·0
80·0 — 85·0
75·0 — 80·0
BELOW 75·0
40 0 40 80 120
Kms.

Fig. 4.5

sectors of the economy in the region have not yet been fully developed, more and more people find their ways in agricultural activity. And that is the reason why there has been this sort of vast growth in the share of agricultural workers. The growth rate of agricultural workers is much larger than that of the growth of workers as a whole.

Growth in Agricultural Workers: The region on an average experienced a growth at the rate of 20.66 per cent in the workers engaged in agriculture. Table IV.4 gives the rate of growth for all the twenty five districts of the region. Map No.4:6 shows a large variation in the growth pattern. The whole of Bihar plains again showed much larger growth rate than that of its counterparts, in east U.P. plains. The highest growth is seen in Saharsa district, where the growth occurred at the rate of around 50.15 per cent. Patna ranks second in the region, which recorded growth rate of 38.93 per cent. Purnea, the adjoining district of Saharsa, being third, records a rate of little less than of Patna. Among other districts which showed growth rates between 30 and 40 per cent are Bhagalpur (37.63) and Darbhanga (33.20 per cent). The rest of the districts from Bihar plain recorded growth rates between 20 and 30 per cent, the lowest being in

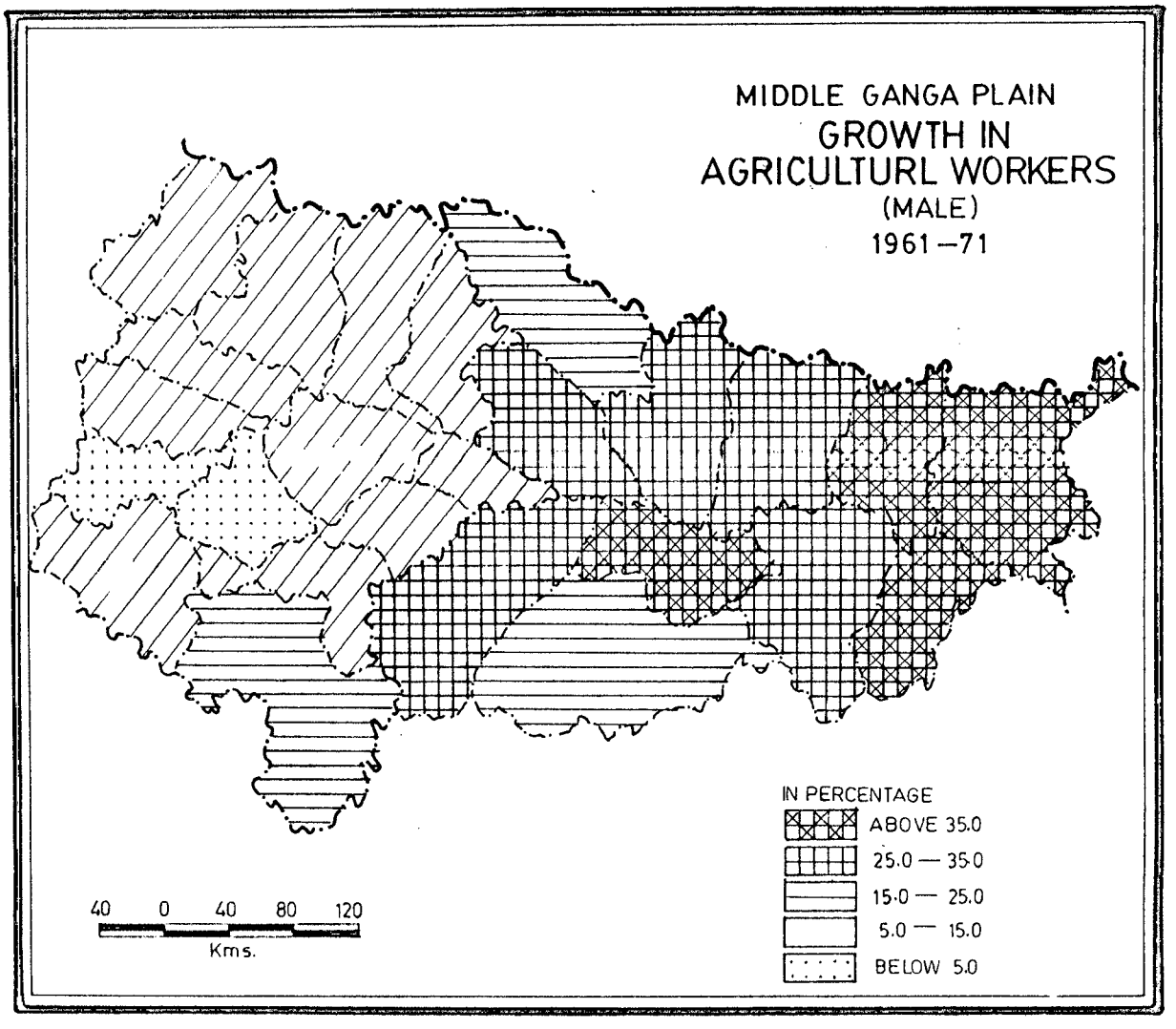

MIDDLE GANGA PLAIN
GROWTH IN
AGRICULTURL WORKERS
(MALE)
1961 –71
IN PERCENTAGE
ABOVE 35.0
25.0 — 35.0
15.0 — 25.0
5.0 — 15.0
BELOW 5.0
40 0 40 80 120
Kms.

Fig. 4.6

Champaran (21.98 per cent).

In the districts of the east U.P. plains, except Mirzapur which recorded 22.66 per cent, in none of the districts, it is above 15 per cent. Ballia which comes after Mirzapur in the rank, showed a rate of 14.85 per cent only. Including Ballia there are seven districts which recorded rates between 10 and 15 per cent. They are Varanasi (12.74 per cent), Gorakhpur (11.46 per cent), Gonda (11.33 per cent), Faizabad (10.75 per cent), Ghazipur (10.13 per cent) and Allahabad (10.03 per cent). The districts according below 10 per cent are Sultanpur, Deoria, Azamgarh, Basti, Partapgarh and Jaunpur. Jaunpur showed the lowest rate.

This growth surpassing the overall growth of workers results in further imbalance in the occupational structure of the economy. Since the other sectors are almost negligible, the percentage share of agricultural workers has further increased. This increasing trend of share of agricultural workers is seen in almost all the districts, except Deoria. It has already been seen that the rate of growth has been much larger in the Bihar plains. Again in these districts the increase in the share has been larger. In the districts of Saharsa, Patna, Shahabad, Darbhanga, Bhagalpur, Gaharsa and Purnea, the change in the share is larger than the average of the region. In

Saharsa the share of agricultural workers moved from 73.57 per cent in 1961 to 81.04 per cent in 1971, the gap between the two being the largest in the region. Patna also showed a larger gap. This change in the share is not equally marked in the case of the east U.P. plain, except Mirzapur in the south of this part. Among the districts of east U.P. plains, it is only Mirzapur which recorded a change larger than the average of the whole region. Ballia ranks second, where the share increased from 78.40 per cent to 84.03 per cent. In the rest of the districts the change has been almost minimal. In fact in majority of the districts, the share has remained at almost the same level.

CHAPTER V

AGRICULTURAL DEVELOPMENT

In the preceding chapters we have seen the demographic characteristics of the region and changes therein during the decade 1961-71. It is found that more than four-fifths of total male workforce is engaged in agricultural sector, which indicates that the region's economy is predominantly agricultural. The tremendous growth in the population in rural areas is another alarming situation. Here in the present chapter we shall see the developments take place in the region during the same period. But before proceeding ahead it is worthwhile to look into the land use profile of the region.

Land Use Profile:

The government records provide informations on land-use under the following categories:

(i) total reporting area for land utilisation,

(ii) land under forests,

(iii) land under non-agricultural usages,

(iv) barren and unculturable land,

(v) permanent pastures and other grazing lands,

(vi) land under miscellaneous tree, crops and groves, not included in the net sown area,

(vii) culturable waste land,

(viii) fallow lands other than current fallows,

(ix) current fallows, and

(x) not area sown.

Table V.1 gives the profile of land use. In the region on the whole very small part of the total reporting area under land utilisation is under forests. However, in the district of Mirzapur as much as 40.35 per cent of the total reporting area is under forest cover. In fact this district covers maximum of the plateaux part of peninsular India. In the rest of the districts it is below 16 per cent (Shahabad ranking second shows 15.9 per cent). There are as many as ten districts, however, which have even less than 5 per cent of their total reporting area under forest.

Area under non-agricultural usages varies 16.55 per cent (in Darbhanga) to 4.66 per cent (in Mirzapur). As many as sixteen districts in the region have even less than 10 per cent of their total reporting areas put to non-agricultural usages. The percentage share of barren and unculturable land is very low in the whole region. The highest share is found in Bhagalpur, the only one in the region which has more than 10 per cent. Similarly area under miscellaneous tree crops and groves not included

Table V.1: Land Utilisation - Percentage Distribution of land under nine categories of the total Reporting area - 1970-72

Districts	Under Forests	Under Non-Agr. Usages	Barren and Un-culturable land	Permanent Pastures & other Grazing land	Land Under Misc. tree crops and Groves not included in NSA	Culturable waste land	Fallow lands other than Current Fallows	Current Fallow	Net Sown Area (NSA)
Patna	0.78	14.43	3.01	0.09	4.99	3.38	6.09	5.08	62.15
Gaya	12.19	9.30	5.38	0.89	0.33	1.32	2.11	9.60	58.88
Shahabad	15.91	9.07	3.65	0.08	0.20	0.58	0.81	2.79	66.91
Saran	-	10.37	4.72	0.29	2.48	0.81	2.46	9.75	69.12
Champaran	9.67	12.33	2.03	0.45	1.67	0.38	1.40	4.42	67.65
Muzaffarpur	-	7.48	2.84	0.25	2.74	0.11	1.25	6.30	79.03
Darbhanga	-	16.55	1.84	0.59	2.75	0.36	1.34	7.19	69.37
Munger	13.83	9.54	8.34	0.59	0.72	2.57	4.13	12.30	47.98
Bhagalpur	8.25	8.58	13.29	0.80	0.81	3.07	3.27	8.90	53.03
Saharsa	-	10.99	5.79	0.60	3.16	2.42	4.88	13.62	58.54
Purnea	0.15	10.45	5.23	0.62	1.93	1.20	2.92	12.85	64.65
Allahabad	2.70	10.15	5.02	0.13	2.80	5.80	2.43	5.83	65.14
Gonda	9.67	8.86	0.66	0.10	2.77	4.07	1.63	2.46	69.78
Faizabad	0.29	11.48	2.43	0.12	6.18	5.39	2.45	2.60	69.06
Sultanpur	0.36	9.02	6.07	0.12	4.44	4.60	2.41	3.06	69.92
Partapgarh	0.09	9.47	6.18	0.10	7.56	4.72	1.99	1.27	68.71
Basti	0.77	10.37	0.82	0.39	2.78	3.78	1.36	3.08	76.65
Gorakhpur	8.67	8.19	0.70	0.06	2.65	1.70	1.44	1.11	74.48
Deoria	0.21	7.53	1.83	0.39	3.13	1.83	1.14	2.51	81.43
Azamgarh	0.03	9.21	3.64	0.12	2.70	3.84	1.33	3.24	76.89
Jaunpur	0.05	7.51	3.41	0.20	2.56	4.63	2.92	3.99	74.73
Ballia	-	9.35	6.27	0.01	3.72	2.36	1.28	2.99	74.02
Ghazipur	-	8.34	2.53	0.24	2.56	2.85	1.76	1.10	80.62
Varanasi	14.93	8.61	2.83	0.01	2.20	2.03	2.07	2.40	64.92
Mirzapur	40.35	4.66	6.16	0.31	2.95	9.33	4.46	3.28	28.48

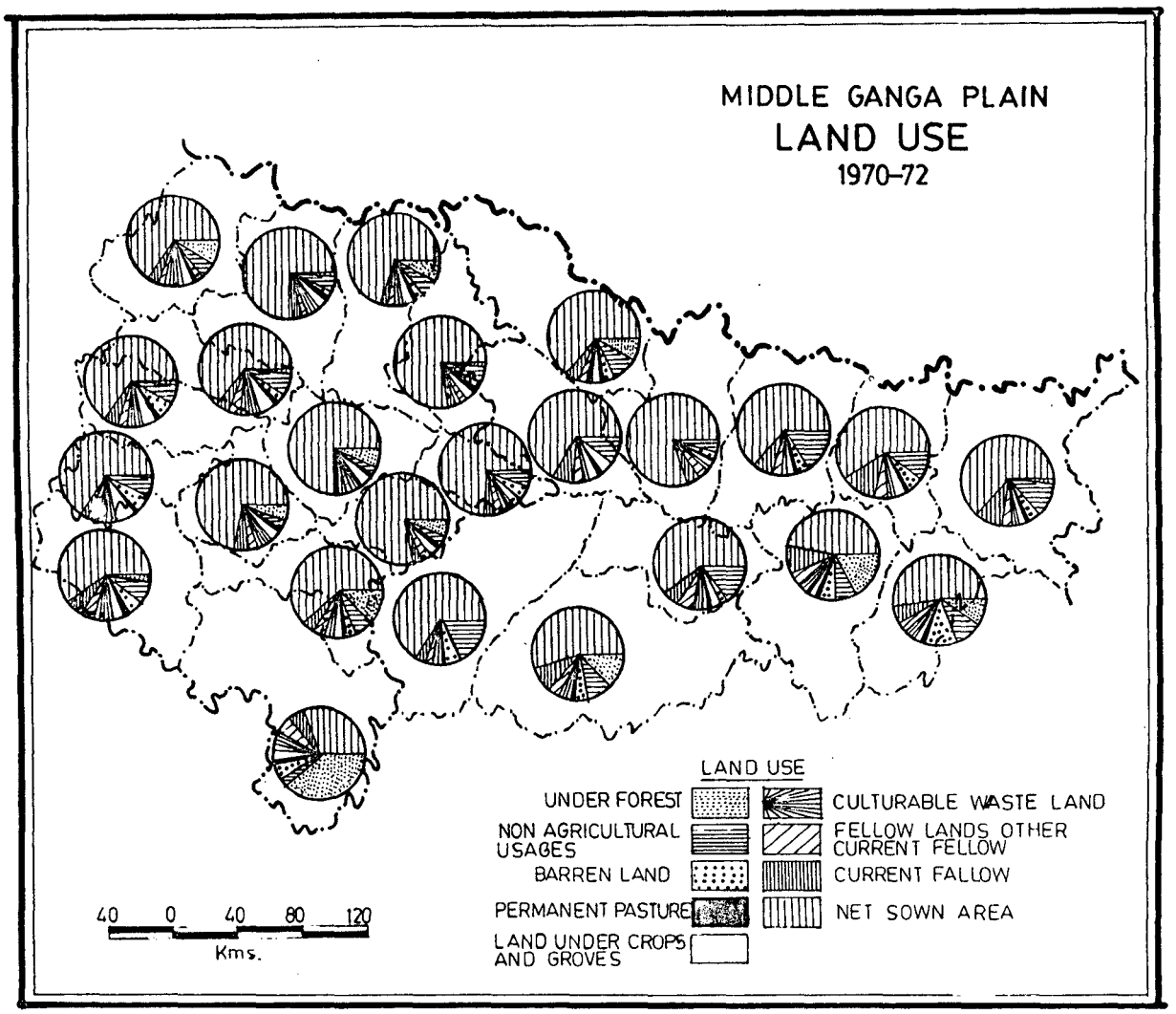

MIDDLE GANGA PLAIN
LAND USE
1970-72
LAND USE
UNDER FOREST
NON AGRICULTURAL USAGES
BARREN LAND
PERMANENT PASTURE
LAND UNDER CROPS AND GROVES
CULTURABLE WASTE LAND
FELLOW LANDS OTHER CURRENT FELLOW
CURRENT FALLOW
NET SOWN AREA
40 0 40 80 120
Kms.

Fig. 5.1

in 'net area sown' is very low. Barring Faizabad (6.18 per cent) and Partapgarh (7.56 per cent), all the districts show even less than 5 per cent of the total reporting land under such usages.

Culturable waste land share is generally high in the districts of east U.P. plains, the highest being in the case of Mirzapur (9.33 per cent). This share declines in the South north and west east direction. In the Bihar plains, it shows an increasing trend roughly from north-west to south-east. Fallow land percentage is highest in Saharsa, the adjoining districts Purnea and Bhagalpur also have larger fallow land percentages. The Bihar plains show generally higher share of fallow levels compared to the U.P. plains. In Gorakhpur a little more than 2 per cent of the total reporting land is found to be fallow.

Mirzapur district reports the smallest percentage of 'net sown area', and excluding Munger all the other districts show the shares more than 50 per cent of the total reporting area. In the Bihar plain, Muzaffarpur (79.03 per cent) records the highest 'net sown area' percentage. This share is again very high in the districts of the east U.P. plains. This percentage distribution of 'net sown area' has already been discussed in the

second chapter in detail. For land use profile see Fig. 5:1.

Now we move to the proceeding sections wherein we will evaluate the developments taken place in the agricultural sectors during the period 1959-62 to 1969-72. It is generally accepted that the development or growth in agricultural production is attributable to, mainly, these factors:

(i) increase in area under crops,

(ii) improvements in the crop yields, and

(iii) improvement in the cropping pattern, that is the substitution of the higher yielding crops for lower yielding ones.

While the reclamation or use of new lands increases the total output, the extensive use of fertilizers, insecticides, extension of irrigation etc. etc. jointly accelerate the production per unit of land, the improvements in the cropping pattern leads to higher returns, in terms of money value, of the land. In the next sections we shall discuss the improvements taken place in these three factors separately.

INCREASE IN AREA UNDER CROPS:

Any increase in the total area under cultivation occurs due to two processes:

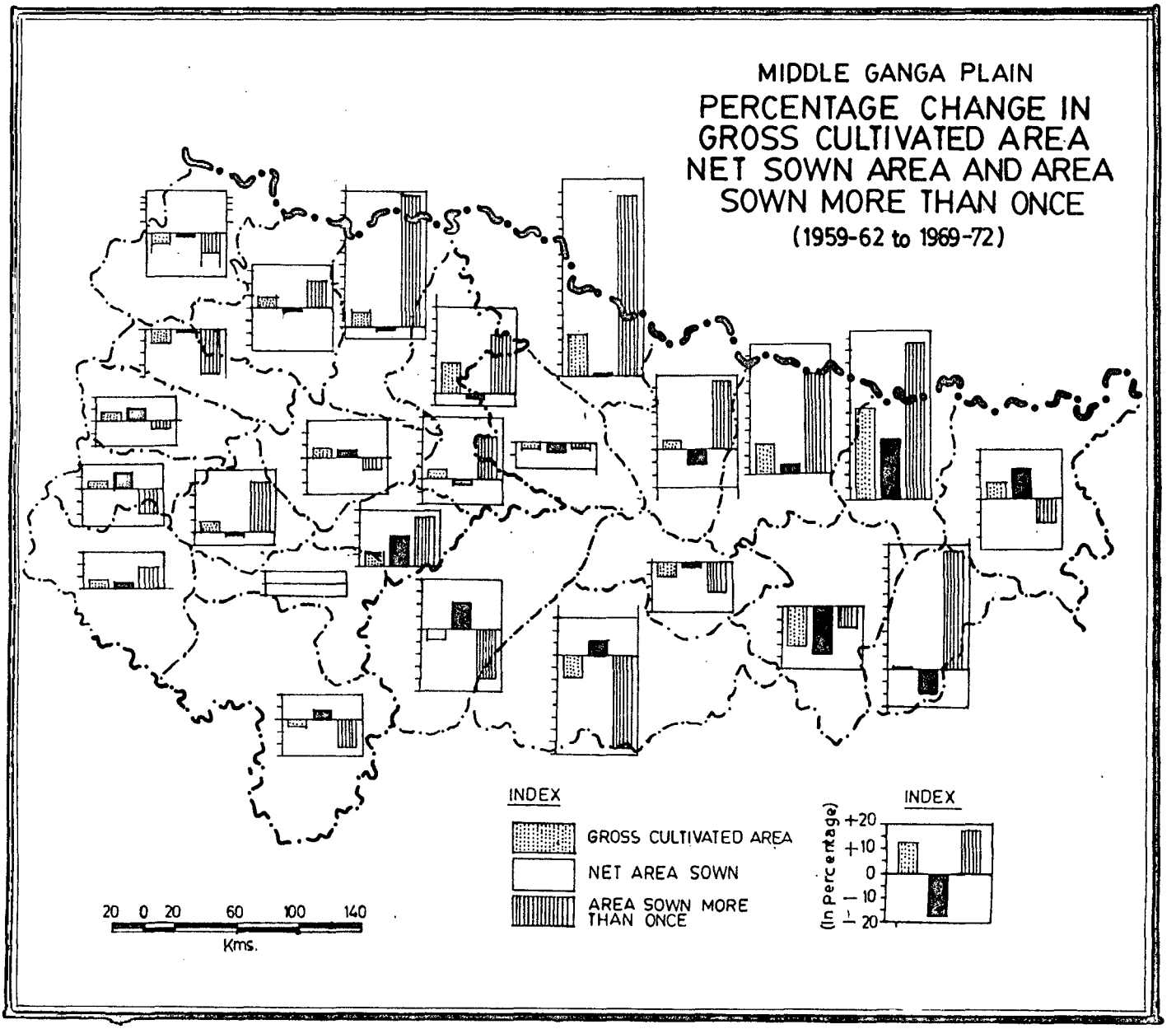
(a) by the process of reclamation of new areas in the total sown area, which were not used for cultivation earlier, and

(b) by the process of growing more than one crop in one season on the already cultivated areas. By this process, the net sown area remains the same but the gross cropped area increases further.

The net sown area is increased by either reclaiming culturable waste lands or by reducing the arable areas left fallow, which is unsown through out the year. But in general large part of this land is poor in quality or inconvenient in location or infested with reeds and bushes, so that costs of reclamation and cultivation are high. The institutional factor is also important. A substantial part of this area is with owners who do not have either the will or the means to bring it under cultivation. The use of fertilisers and improved techniques should reduce the need to keep land fallow with a view to building up its strength in plant nutrients. The net sown area may thus be expended at the expense of fallow land. A realistic assessment of all these possibilities suggests that the scope for further increases in the cropped area lie largely in improvement in cropping intensity.

Table V.2: Percentage Changes in Gross Cropped, Net Cropped Areas and Areas Sown More than Once 1959-62 to 1969-72

Name of the Districts	Gross Cropped Area	Net Cropped Area	Area Sown More than Once
Patna	- 4.52	- 1.41	-11.95
Gaya	- 8.89	+ 5.26	-36.60
Shahabad	- 3.35	+ 9.35	-21.04
Saran	- 1.95	- 2.15	- 1.39
Champaran	+15.68	+ 0.001	+74.43
Muzaffarpur	+ 1.52	- 5.01	+27.12
Darbhanga	+10.78	+ 2.80	+41.90
Munger	-15.90	-18.05	- 8.40
Bhagalpur	+ 0.003	- 9.75	+45.97
Saharsa	+35.54	+27.29	+62.46
Purnea	+ 5.81	+11.45	- 3.54
Allahabad	+ 2.80	+ 1.32	+ 8.35
Gonda	- 2.10	- 0.05	- 5.78
Faizabad	- 5.12	- 0.001	-17.00
Sultanpur	+ 3.11	+ 4.72	- 2.07
Partapgarh	+ 2.68	+ 6.08	- 0.74
Basti	+ 4.77	- 0.01	+ 9.11
Gorakhpur	+ 2.98	- 0.005	+53.65
Deoria	+11.09	- 1.11	+22.18
Azamgarh	+ 2.66	+ 2.08	+ 4.93
Jaunpur	+ 3.95	- 0.001	+ 20.06
Ballia	+ 2.14	- 1.97	+17.32
Ghazipur	+ 6.15	+ 3.09	+19.54
Varanasi	+ 0.001	+ 0.004	- 0.002
Mirzapur	- 1.53	+ 1.58	-11.17


MIDDLE GANGA PLAIN
PERCENTAGE CHANGE IN GROSS CULTIVATED AREA NET SOWN AREA AND AREA SOWN MORE THAN ONCE
(1959-62 to 1969-72)
INDEX
GROSS CULTIVATED AREA
NET AREA SOWN
AREA SOWN MORE THAN ONCE
INDEX
(In Percentage)
+20
+10
0
-10
-20
20 0 20 60 100 140
Kms.

Map. 5.2

The district wise figures of the growth in the gross cultivated area, net sown area and area sown more than once shown in the Table V.2 present a large range of variation from one part to another. There are as many as eight districts in the region which show decline in the gross cropped area. They are Patna, Gaya, Shahabad, Saran and Munger (in the Bihar plains), and Gonda, Faizabad and Mirzapur (in the east U.P. plains). The largest decline has occurred in Munger district in the south eastern part of the region, where the total cropped area has declined by nearly 16 per cent. The second largest decline is seen in Gaya, nearly 9 per cent. Saran in the eastern Saryupar plain and Mirzapur in the southeastern part of the east U.P. plains, have recorded a very marginal decline over the period.

In the rest of the districts, there has been some increase. However, quite a good number of districts showed a very insignificant growth. For example, Partapgarh and Varanasi showed a growth of merely 0.003 and 0.001 per cent respectively.

The districts which recorded growth of between 1 and 5 per cent are Muzaffarpur, Allahabad, Sultanpur, Partapgarh, Basti, Gorakhpur, Azamgarh, Jaunpur and Ballia.

Two districts only recorded growth between 5 and 10 per cent and they are Purnea and Ghazipur. Darbhanga and Deoria showed an increase by the rates between 10 and 15 per cent. Only in the districts of Saharsa and Champaran we find some markable growth in the gross cultivated area. (See fig. 5.2)

Net Cultivated Area: During the period 1959-62 to 1969-72, the whole region recorded a very marginal or insignificant growth in the net area under cultivation, an addition of merely 325611 hectares. This comes to be only 1.21 per cent increase from 1960's to 1970's. Almost half of the total districts showed a decline in the net cropped area. The largest decline is seen in the eastern part of the south Bihar plain, mainly in Munger and Bhagalpur. In these districts negative growth rates were 19.05 per cent and 9.75 per cent respectively. Five adjoining districts in the Doryupur plain - Saran, Deoria, Gorakhpur, Basti and Gonda - showed decline over the period. This rate of decline, however, comes down from east to west. Ballia in the eastern Ganga-Ghaghra Doab also reported a slight fall in area. Though Faizabad also experienced shrinking of net area, it is very insignificant.

It is evident that there are four districts forming contiguous pockets, have experienced considerable increase

Table V.3: Percentage Share of 'Area Sown more than once' to the 'net sown area'

Name of the Districts	1961	1971	Difference between 1961 & 1971
Patna	54.29	48.48	- 5.81
Gaya	51.24	38.16	-13.08
Shahabad	68.30	48.75	-19.55
Saran	34.41	34.67	+ 0.26
Champaran	25.78	44.71	+18.93
Muzaffarpur	27.08	36.34	+ 9.26
Darbhanga	25.11	34.63	+ 9.52
Munger	27.65	30.90	+ 3.25
Bhagalpur	22.05	35.66	+13.61
Saharsa	30.66	39.13	+ 8.47
Purnea	42.24	35.06	- 7.18
Allahabad	26.77	28.62	+ 1.85
Gonda	41.70	39.31	- 2.39
Faizabad	41.26	33.89	- 7.37
Sultanpur	31.94	29.87	- 2.07
Partapgarh	27.35	23.27	- 4.08
Basti	33.15	40.96	+ 7.81
Gorakhpur	32.75	35.38	+ 2.63
Deoria	27.25	42.10	+14.85
Azamgarh	25.13	25.83	+ 0.70
Jaunpur	25.43	30.58	+ 5.15
Ballia	27.04	32.37	+ 5.33
Ghazipur	22.90	26.55	+ 3.65
Varanasi	35.86	35.65	- 0.21
Mirzapur	32.22	28.18	- 4.04

in the net area under various crops. The most significant is the one formed by Purnea and Saharsa, in the extreme east of North Bihar plain. Of the absolute increase in the whole region, these two districts alone contributed nearabout 45 per cent. The second pocket is formed by Gaya and Shahabad in the western margin of the South Bihar plain, which accounts for nearly 31 per cent in the gross addition. The other two pockets, formed by Sultanpur and Partapgarh in the western half of the east U.P. plains and Ghazipur and Azamgarh account for 8.75 per cent and 5.25 per cent respectively. The rest 10 per cent of the reclamation of new lands is contributed by Champaran, Darbhanga, Allahabad, Varanasi and Mirzapur jointly. (Fig 5:2)

Area Sown More than Once: During the recent past, it has been strongly felt that since further reclamation of new land is becoming uneconomical day by day, it is only through increasing the intensity of cropping that the increasing food demand can be met. The increasing use of chemical fertilisers had made it possible to grow more than one crop from the same piece of land without adversely affecting the quality of soil. Apart from the use of fertilisers, the suitable systems of crop rotation, whereby different plants draw plant nutrients from the soil in different proportion of or from different strata,

can result in tremendous growth in agricultural production without causing any damage to the soil fertility. Certain crops, known as leguminous crops, for example, gram, return nitrogen to the soil which is largely consumed by other crops. They thus facilitate multiple cropping by preserving the fertility of the soil.

Again let us look at the Table V.2. In the region, on the whole 483597 hectares of new land was brought under multiple cropping, however the net addition was only 131903 hectares. In the whole north Bihar plain, excepting Saran and Purnea, area under multiple cropping has increased. These districts are Champaran, Muzaffarpur, Darbhanga and Saharsa, which together contribute to 57.08 per cent of the gross addition. The largest increase came from Champaran. In the South Bihar plain, it is only Bhagalpur which increased its double cropped area.

In the east U.P. Deoria, Gorakhpur and Basti from another belt, which in fact is the continuation of the one in the north Bihar plain. This accounts for around 25 per cent of the gross increase. Another belt is found in the Ganga-Ghaghra Doab area consisting of Ballia, Azamgarh, Ghazipur, Jaunpur and Allahabad. This belt brought only 11.18 per cent of the total area brought under multiple sowing.

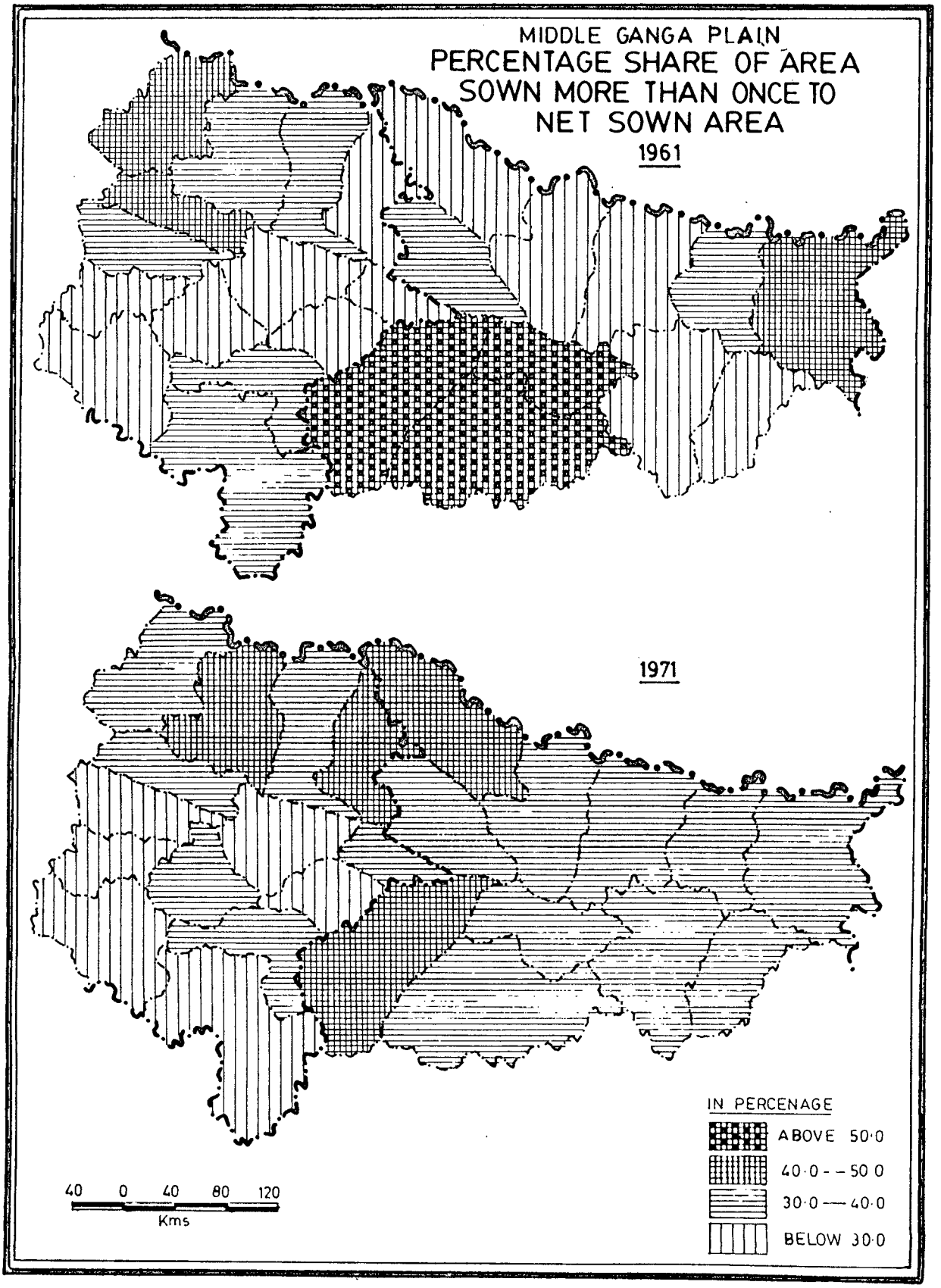

MIDDLE GANGA PLAIN
PERCENTAGE SHARE OF AREA SOWN MORE THAN ONCE TO NET SOWN AREA
1961
1971
IN PERCENAGE
ABOVE 50·0
40·0 - - 50 0
30·0 — 40·0
BELOW 30·0
40 0 40 80 120
Kms

Fig. 5.3

In all the rest districts total area under multiple sowing has shrinked over the period, 1959-62 to 1969-72. In most of the cases the decline is so large that the gross cropped area declined considerably. (See fig 5:2)

It would be very important to see the changes in percentage share of the multiple sowing areas to the net cultivated areas. This would reveal the relative changes in both. Table V.3 gives the same. It is revealed that all the districts, which recorded negative growth in 'area sown more than once' have shown decline in their percentage shares, barring the two in the Bihar plains, name Saran and Munger. Here, in spite of the fact that the total area under multiple sowing has declined, the share has marginally increased. This is because of steeper decline in 'net sown area' than 'area sown more than once'. The largest increase and decrease in the shares have occurred in Champaran and Shahabad respectively. It may be recalled that it was Champaran which recorded the highest growth rate in the double sown area. (See fig 5:3)

IMPROVEMENTS IN THE YIELD: Since the amount of land is limited and demand of food is increasing day by day, improvement in crop yields, that is the production of different crops, per unit of land, has become an important factor in increasing the overall agricultural production.

To meet this objective, the following ways and means are adopted:

(i) extension of irrigation;

(ii) use of fertilisers;

(iii) introduction of high yielding varieties;

(iv) plant protection measures;

(v) soil improvement; and

(vi) adoption of superior agronomic practices.

The factors (iv) and (v) have not been included in our study, due to limited space and time. The data on high yielding varieties and improvement in agronomic practices are not easily available. Moreover, in a region like Middle Ganga plain, where there has not been any remarkable change in the agronomic practices during the period under study, it is of not much of importance to be discussed here. Similarly, as far as the contribution of high yielding varieties of seeds are concerned, it should be remembered that during the mid sixties only HYV was introduced, hence no comparison can be made 1959-62 and 1969-72.

Thus in the succeding sections of this chapter we shall evaluate the role of the two factors: irrigation and fertilisers only.

Table V.4: Changes in the percentage share of Net Irrigated Area

Districts	(1959-62)	(1969-72)	Difference
Patna	64.36	62.95	- 1.41
Gaya	76.68	77.12	+ 0.44
Shahabad	68.97	67.23	- 1.74
Saran	15.74	29.10	+13.36
Champaran	12.76	25.98	+13.22
Muzaffarpur	4.16	6.29	+ 2.13
Darbhanga	2.34	10.02	+ 7.68
Munger	22.40	28.21	+ 5.81
Bhagalpur	23.55	37.00	+13.45
Saharsa	4.12	14.97	+10.85
Purnea	0.004	17.82	+17.82
Allahabad	22.57	27.83	+ 5.26
Varanasi	46.35	49.56	+ 3.21
Mirzapur	22.71	26.12	+ 3.41
Jaunpur	51.95	52.06	+ 0.11
Ghazipur	36.66	39.04	+ 2.38
Ballia	34.85	42.46	+ 7.61
Gorakhpur	37.21	46.39	+ 9.18
Deoria	34.62	44.81	+10.19
Basti	43.67	53.29	+ 9.62
Azamgarh	49.99	52.73	+ 2.74
Faizabad	49.52	52.12	+ 2.60
Gonda	25.23	26.03	+ 0.80
Sultanpur	37.64	41.96	+ 4.32
Partapgarh	38.42	39.06	+ 0.64

Irrigation: In this region, or any other, where agriculture has held a dominant position in the economy and where this occupation is rendered hazardous by erratic rainfall both in time and space, irrigation becomes very important. In the earlier chapter we have seen the spatial and temporal nature of the distribution of rainfall in the region. The seasonal concentration and ill distribution of rainfall, both in space and time, and other monsoon vagaries necessitates supplemental irrigation for the farming operations and agricultural land use of the region.

In the region, of the net area sown, on an average around 39 per cent is under irrigation, but there is a wide subregional and local variation in the percentage distribution of net irrigated area, depending on the irrigational needs, type of terrain, crops raised and availability of water sources. In general, the areas of relatively higher rainfall and lower variability have lesser percentage of net irrigated area.[1] While on average, in the years 1969-72, the Bihar plains have only 24.81 per cent of net sown area under irrigation, in the east U.P. plains, as much as 42.17 per cent is irrigated.

Table V.4 gives the district-wise percentage distribution of net irrigated area to net sown area for both the two points of time. In the more rainy

1. R.L. Singh, India, A Regional Geography, p.235.

'North Bihar plains', in the year 1970's the districts of Muzaffarpur and Darbhanga report 6.29 per cent and 10.02 per cent, respectively, of the net area cultivated under irrigation, while the less rainy 'South Bihar plains', for example, in Patna, Gaya and Shahabad districts, more than 60 per cent of the net sown area is irrigated. Similarly Purnea and Saharsa, taken together, in the Kosi plains of the north Bihar plain, have on average only 10.87 per cent. It is here that the highest amount of rainfall is received with least variability. Again Bhagalpur and Munger report the percentage of irrigated area to be 37.00 and 28.21 respectively.

Among the districts of the east U.P. plain the highest percentage share of net irrigated area is found in the Ganga-Ghaghara doab region. This is a zone of 95 to 110 cm. of rainfall.[1] Jaunpur, Azamgarh and Faizabad all have above 50 per cent irrigated area. The lower doab districts of Ballia and Ghazipur have 42.46 per cent and 39.04 per cent irrigated area, respectively.

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1. Ibid.

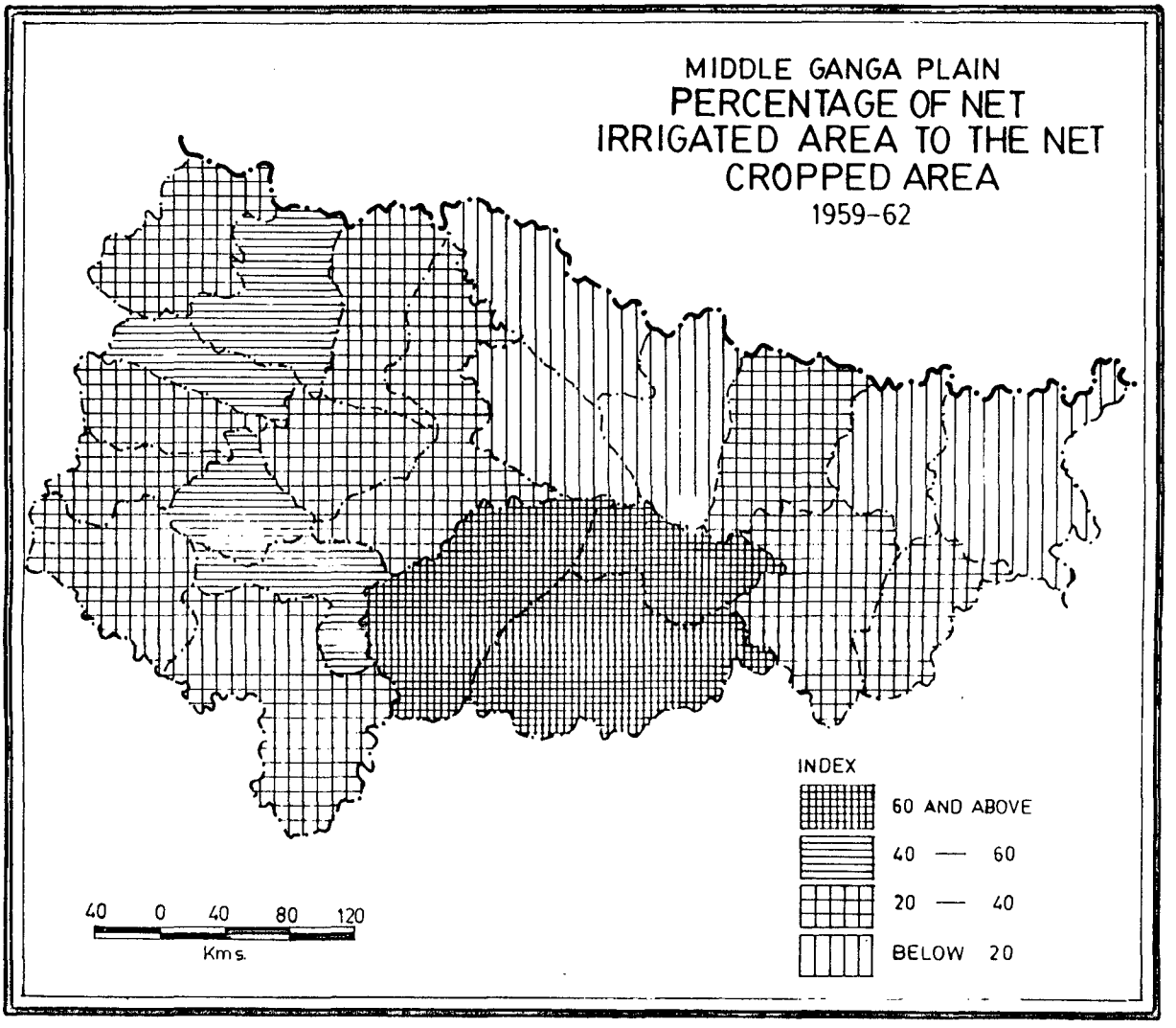
MIDDLE GANGA PLAIN
PERCENTAGE OF NET IRRIGATED AREA TO THE NET CROPPED AREA
1959-62
INDEX
60 AND ABOVE
40 — 60
20 — 40
BELOW 20
40 0 40 80 120
Kms.

Fig. 5.4a

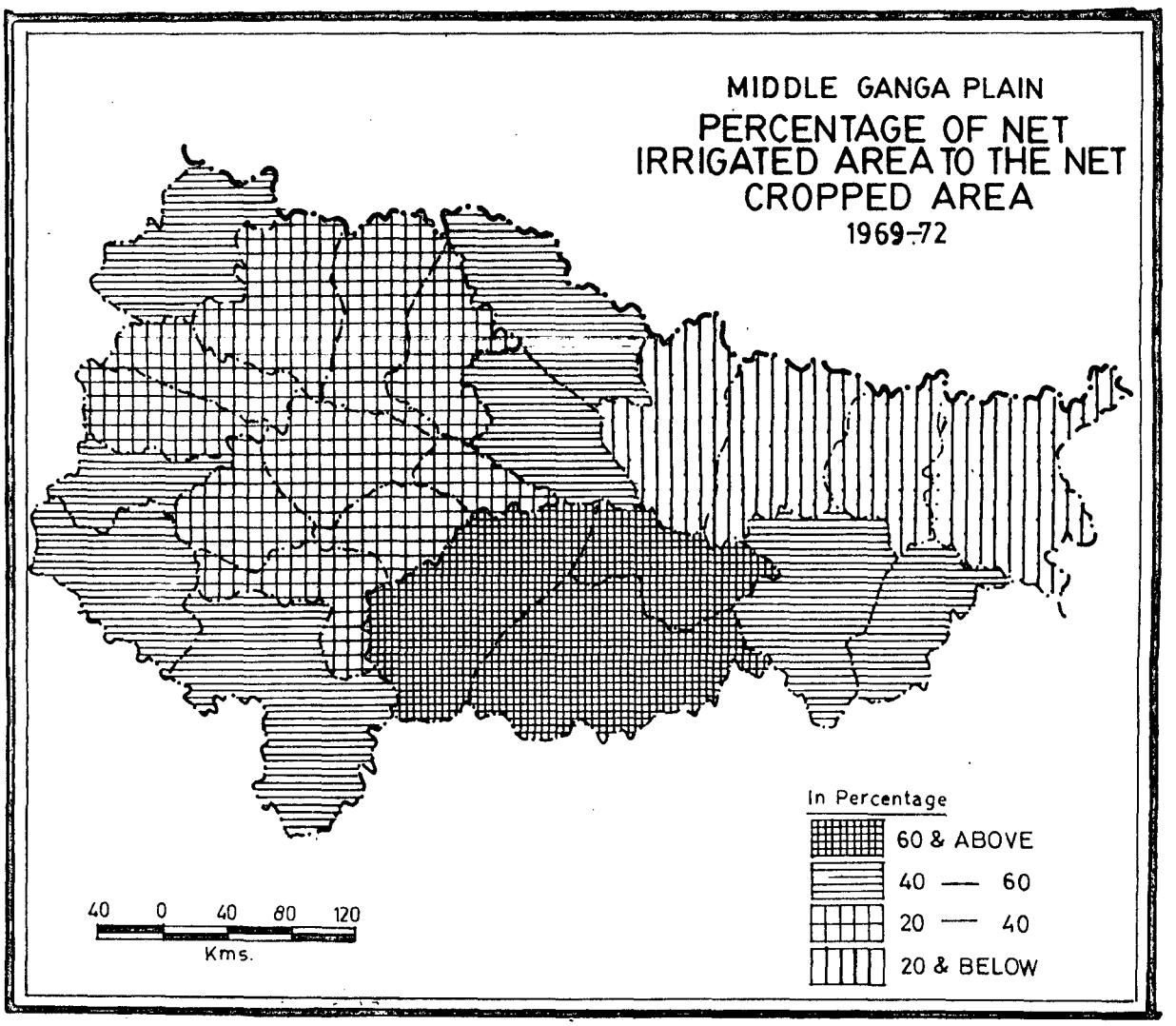
MIDDLE GANGA PLAIN
PERCENTAGE OF NET IRRIGATED AREA TO THE NET CROPPED AREA
1969-72
In Percentage
60 & ABOVE
40 — 60
20 — 40
20 & BELOW
40 0 40 80 120
Kms.

Fig 5.4b

In the Saryupur plains there is an increasing trend in the percentage share of irrigated area from east to west, except Gonda. Deoria in the extreme east irrigates around 44.81 per cent of its net sown area, Gorakhpur around 46.39 per cent and Basti more than half (53.29 per cent).

As against these, the districts in the south, Mirzapur and Allahabad irrigate only 26.12 per cent and 27.83 per cent respectively. Further north of Mirzapur, in the Varanasi district this share increases suddenly to 49.56 per cent. (Figs. 5.4a and 5.4b)

Changes in the Share (1959-62 to 1969-72): It is seen from the Table V.4 that in all the districts, excepting two Patna and Shahabad, there has been increase in the share of irrigated area. These two districts have experienced decline by even less than 2 per cent. The average increase in the region between 60's and 70's was around 5.44 per cent. There are eleven such districts - Saran, Champaran, Darbhanga, Munger, Bhagalpur, Saharsa and Purnea (in the Bihar plain) and Ballia, Gorakhpur, Deoria and Basti (in the U.P. plains), which have reported larger increase than the average for the region. On the other hand Gaya, Jaunpur, Gonda, and Partapgarh have reported very marginal change over the period. The

The changes in the share among these districts is below 5.44 per cent.

Fertiliser Consumption: From time immemorial, the Indian cultivators have been using animal dung, compost, bones and other organic manures to restore to the soil the nutrients, mainly nitrogen, phosphorous and potassium used by the growing plants as well as lost in other ways. The land was also frequently left fallow to enable it to rebuild its nutrient strength. Practices such as green manuring or cultivation of legumes which fix atmospheric nitrogen and enrich the soil, saved the same purpose.

The recently growing need of more and more food has compelled the Indian cultivators to make use of more and more chemical fertilisers to replenish the soil with plant nutrients.[1] The accelerated growth of population has necessitated a rapidly expanding supply of food and other farm products. This calls for an increase in the cropped area through multiple cropping as well as higher yields per unit of land. Use of these chemical fertilisers has made possible both the two objectives. On the one hand, the cultivators may grow more than one crop in a single season from the same piece of land,

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1. Datt, R. and Sundram, K.V.M., Indian Economy, New Delhi, 1985, p.390.

Table V.5: Fertiliser Consumption in kg/hectare

Districts	1961	1971	Difference
Patna	6.15	19.49	13.34
Gaya	1.56	7.93	6.38
Shahabad	1.30	19.65	18.27
Saran	1.10	17.99	16.89
Champaran	0.89	16.17	15.28
Muzaffarpur	0.68	8.38	7.7
Darbhanga	0.64	7.78	7.14
Munger	0.73	13.22	12.49
Bhagalpur	2.13	6.49	4.36
Saharsa	0.10	7.63	7.53
Purnea	0.10	3.00	2.90
Allahabad	1.68	17.14	15.46
Varanasi	1.88	29.78	27.90
Mirzapur	0.82	8.26	7.44
Jaunpur	1.36	26.21	24.85
Ghazipur	1.54	17.41	15.87
Ballia	0.70	17.96	17.26
Gorakhpur	1.50	26.36	24.86
Deoria	1.77	30.56	28.86
Basti	0.84	8.65	7.81
Azamgarh	0.09	18.64	18.55
Faizabad	2.05	40.72	38.67
Gonda	0.34	22.07	21.73
Sultanpur	0.61	22.39	21.78
Partapgarh	1.12	19.10	17.98

on the other it raises the total production per unit of land. The use of fertilisers, proves to be more fruitful when applied to an irrigated land with high yielding varieties of seeds. All these have led to a tremendous growth in the use of chemical fertilisers during the period in the region.

In spite of the good progress made in recent years the use of fertilisers is yet much below the desired level in the region. Table V.5 gives the amount of fertiliser consumption per hectare of land for the period 1959-62 and 1969-72, for all the districts.

During the years 1959-62, the average amount of fertiliser consumed in the region was 18938 tonnes. If the extensive area under agriculture is considered, it can easily be said that the fertiliser consumption was one among the lowest in the country. Though, after a period of ten years the total used fertilisers rose to near about 248454 tonnes in 1969-72, it is yet much below the required level. The per hectare consumption was around 1.26 kgs in 1960's, and 16.23 kgs in 1970's. The figures for per hectare consumption of chemical fertilisers in India during the periods, 1960-61 and 1970-71, where 1.9 and 13.6 kgs.[1]

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1. Ibid., Table 3, p.391.

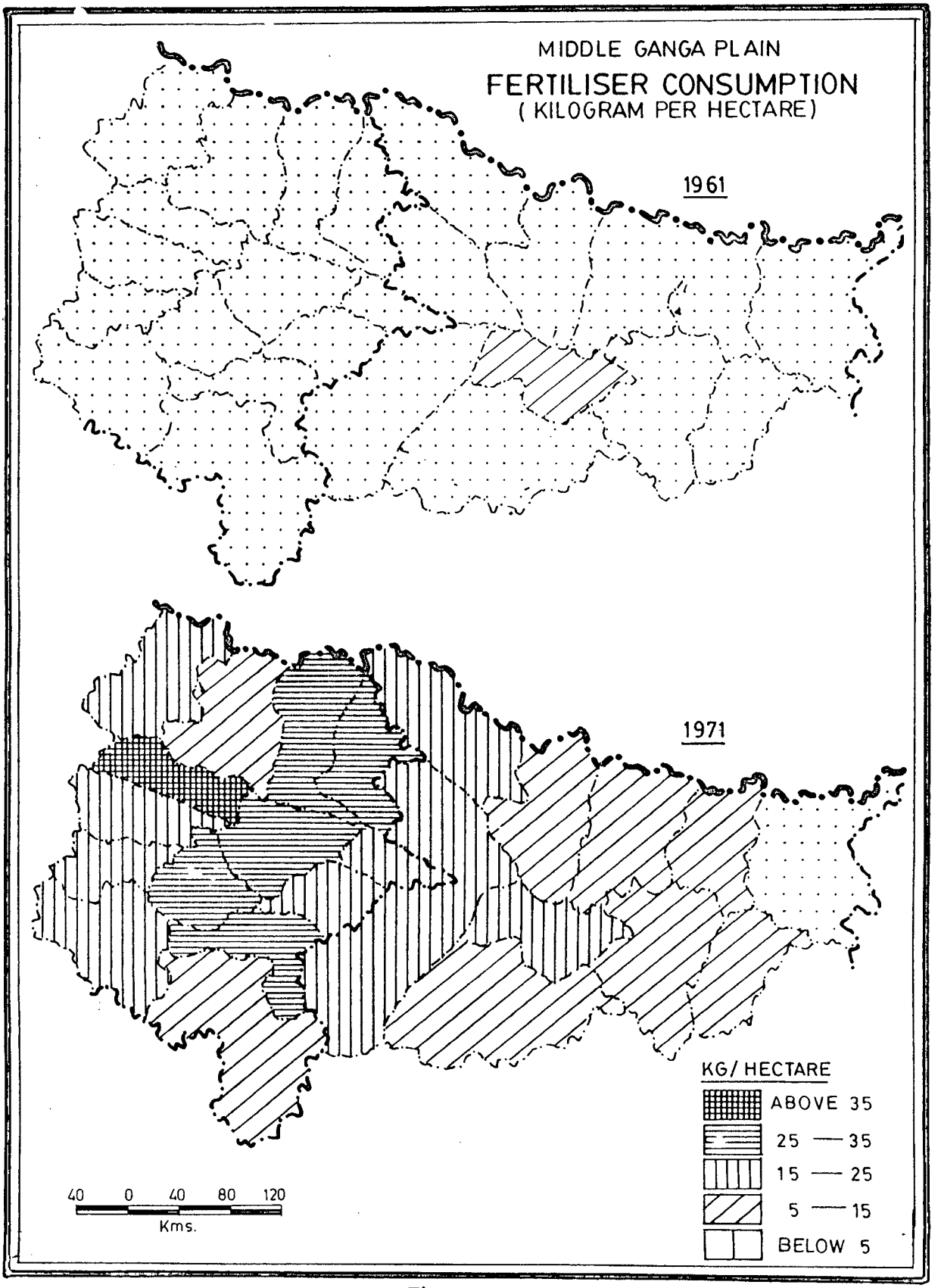
MIDDLE GANGA PLAIN
FERTILISER CONSUMPTION
(KILOGRAM PER HECTARE)
1961
1971
KG/ HECTARE
ABOVE 35
25 — 35
15 — 25
5 — 15
BELOW 5
40 0 40 80 120
Kms.

Fig. 5.5

In as many as twelve districts, the per hectare consumption was even below one kilogram. These districts are Champaran, Muzaffarpur, Darbhanga, Munger, Saharsa, Purnea, Mirzapur, Ballia, Basti, Azamgarh, Gonda and Sultanpur. There were ten districts, Gaya, Shahabad, Saran, Allahabad, Varanasi, Jaunpur, Ghazipur, Gorakhpur, Deoria and Partapgarh which consumed between 1 and 2 qs. The rest of the districts consumed above 2 qs. However, Patna reported the highest consumption of 6.15 qs.

All the districts experienced growth in the per hectare consumption of chemical fertilisers. The average increase of the whole region has around 15 qs per hectare. However, this increase in the per hectare consumption was not uniform. On the whole, the western half, the east U.P. plains, experienced a larger increase than the Bihar plains. While Faizabad increased its per hectare consumption by as much as 39 qs, Purnea raised its consumption by merely 2.90 qs. There are eight districts which raised the consumption by upto ten kilograms. Out of this, six are found in the Bihar plains. The rest of the five districts of the Bihar plains - Patna, Shahabad, Saran, Champaran and Munger - raised their levels of consumption by 10 to 20 qs. (Fig. 5.5.)

In the east U.P. plains, as has already been stated, comparatively larger increases have taken place in the level of consumption. This part of the region showed a growth in the per hectare consumption by more than 20 kgs, which is almost double to that of its counterpart, the Bihar plains. There were two districts only - Mirzapur and Basti - which raised the consumption by less than 10 kgs. Allahabad, Ghazipur, Ballia, Azamgarh and Partapgarh showed increase between 10 to 20 kgs. Again five districts - Varanasi, Jaunpur, Gorakhpur, Deoria, Gonda and Sultanpur - increased their consumption by between 20 and 30 kgs. Faizabad increased by the highest margin, 39 kgs.

IMPROVEMENT IN THE CROPPING PATTERN:

The improvement in cropping pattern is also a major factor which brings development or progress in agriculture. The improvement in cropping pattern affects the growth in two ways. Firstly, there are certain crops which absorb comparatively more labours, such as rice, wheat etc. By bringing more and more land under the cultivation of such crops, the growth in the agricultural labours can be supported. Secondly, by this process, the overall money value of crops is accelerated. This results in increase in both land and labour productivity. Hence in the following sections we shall see the changes in

the cropping pattern between the two points of time. We shall see simply the changes in the percentage share of area under certain crops which affect the overall absorption of agricultural workers as well as increases the productivity. For this we have selected the crops such as rice, wheat and sugar cane.

Table V. gives the share of all the eight crops in the gross cultivated area during the periods 1959-62 and 1969-72. The changes in the shares of these three crops show that not a very good picture emerges from it. In the case of rice, though there has been increase in the share, in maximum of the cases the increases have been very insignificant. There are as many as eight districts where the changes have occurred by even less than 2 per cent. Largest increase in the shares are noticed in Saharsa and Ghazipur districts. There are seven districts which showed decrease in the share, largest being in the case of Patna. However, some of them have recorded very insignificant decline. The average share in the region increased from 36.51 per cent in 1959-62 to 38.04 per cent in 1969-72.

As against this one, the area under wheat cultivation has increased in all the twenty five districts of the region. This increase in the share is slightly larger

in the Bihar plains than the east U.P. plains. On an average the share in the region rose from 9.76 per cent in 1959-62 to 16.39 per cent in 1969-72. These changes are more significant in the cases of Shahabad, Gorakhpur and Deoria. In Varanasi, the share of gross cropped area under wheat, however, declined considerably. In the rest of the districts there are either high or medium changes.

The share under sugarcane cultivation has declined from 1960's to 1970's, though very marginally. The share was 3.29 per cent in 1959-62 which became 3.03 per cent in 1969-72. The same picture emerges in the case of other crops also. It can be inferred from the given table that there has not been any significant change in the cropping pattern of the region during the period of ten years. Now let us see the growth pattern in the agricultural output and productivity level of the region. These two, agriculture output and productivity level, in fact, are the function of the factors discussed above.

GROWTH IN AGRICULTURAL OUTPUT:

Table V.6 summarises the agricultural growth rate for all the districts during 1962-63 to 1970-71. A large range of variation can be noticed in the growth

Table V.6: Agricultural Growth Rate[1] - Districtwise, 1962-65 to 1970-73

Districts	Growth* Rate
Patna	9.20
Gaya	- 8.50
Shahabad	26.5
Saran	37.7
Champaran	31.9
Muzaffarpur	-
Darbhanga	4.90
Munger	- 3.90
Bhagalpur	2.87
Saharsa	- 3.90
Purnea	-22.90
Allahabad	17.40
Gonda	12.80
Faizabad	15.00
Sultanpur	15.40
Partapgarh	4.80
Basti	26.60
Gorakhpur	26.90
Deoria	22.50
Azamgarh	8.60
Jaunpur	11.30
Ballia	19.00
Ghazipur	35.50
Varanasi	- 8.40
Mirzapur	4.90

* Source: Table No.198, Country Monograph Series No.10, Population of India, ESCAP, U.N., New York, 1982.

1. Originally these figures were given on Annual Growth Rate (Exponential), but have been multiplied by 10 to derive decadal growth.

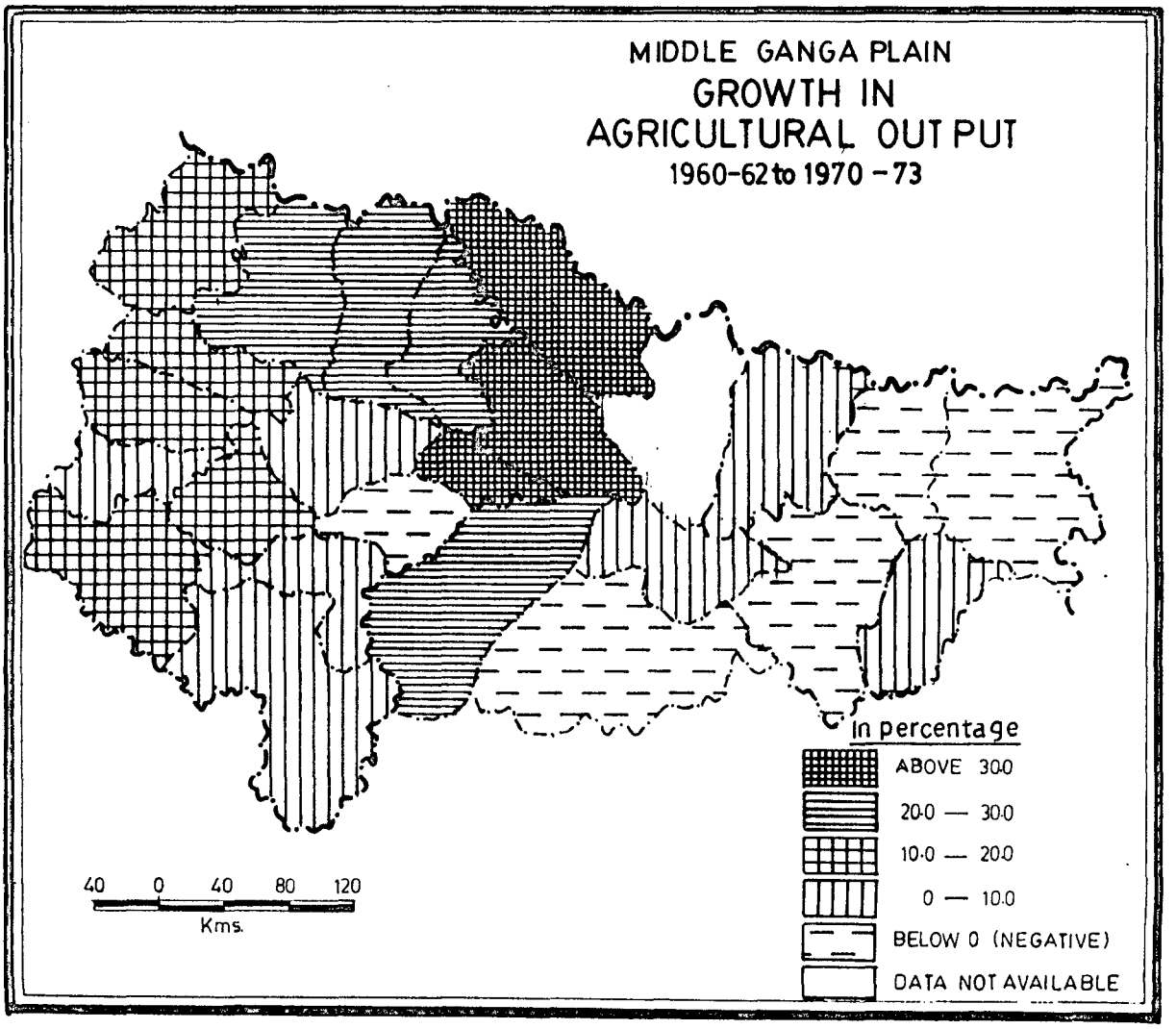
MIDDLE GANGA PLAIN
GROWTH IN
AGRICULTURAL OUTPUT
1960-62 to 1970 - 73
In percentage
ABOVE 30.0
20.0 — 30.0
10.0 — 20.0
0 — 10.0
BELOW 0 (NEGATIVE)
DATA NOT AVAILABLE
40 0 40 80 120
Kms.

Fig. 5.6

of agricultural output in the region. While on the one hand Saran (in the north west of the Bihar plains) and Ghazipur (in the eastern Ghaghara-Ganga doab) recorded growth in the output of 37.7 per cent and 35.50 per cent respectively, the total output declined by as much as 22.9 per cent in the district of Purnea (in the Kosi plains). Apart from Purnea, there are other four districts where the agricultural output has declined. They are Gaya (-8.5 per cent), Saharsa (-3.9 per cent), Munger (-3.9 per cent), and Varanasi (-8.4 per cent).

The districts of Patna, Bhagalpur, Darbhanga (all in the Bihar plains), Partapgarh, Azamgarh and Mirzapur (in the U.P. plains), have all recorded very slow growth, the rate varying upto 10 per cent. In the category of medium growth rate (10 to 20 per cent), the districts of Allahabad (17.4 per cent), Gonda (12.8 per cent), Faizabad (15.0 per cent), Sultanpur (15.4 per cent), Jaunpur (11.3 per cent), Ballia (19.0 per cent) etc. are included.

Shahabad, Basti, Gorakhpur & Deoria have recorded high growth, the rates being between 20 and 30 per cent. Very high growth in the agricultural output can be seen in the districts of Saran, Champaran and Ghazipur, all recording growth rates more than 30 per cent over the period 1959-62 to 1969-72. (Fig. 5.6)

PRODUCTIVITY:

The concept of productivity is a very broad one and includes technological advancements, effective managements of available resources and organisational set up for the agricultural production. The exact agricultural output of any region, in fact, is the combined effect of all these factors. The productivity of agriculture has been seen in many ways by various authors and the frequently methods are to explain it in terms of land or labour or both the two. Here in the present study after converting the total output of different crops into money value land and labour productivity have been worked out. The following are the changes taken place in land productivity and labour productivity.

LAND PRODUCTIVITY: With the increasing pressure of man on land, the use of land productivity is becoming day by day popular. To meet the increasing demand of food, the land productivity is generally accelerated by raising multiple crops in a single season and by substituting the low value crops by high value crops. The land productivity of any region is expressed in terms of per unit of land (usually in hectare).

Table V.7: Land Productivity - Districtwise
(in Rs./hectare)

Districts		
Patna	1754	1874
Gaya	1488	1336
Shahabad	1506	1676
Saran	1163	1776
Champaran	1231	1706
Muzaffarpur	1002	1192
Darbhanga	1170	1230
Munger	1085	1090
Bhagalpur	1061	1522
Saharsa	1088	1091
Purnea	1252	1037
Allahabad	970	1098
Gonda	968	1100
Faizabad	1329	1398
Sultanpur	1146	1154
Partapgarh	979	973
Basti	1214	1416
Gorakhpur	1590	1446
Deoria	1597	1739
Azamgarh	1264	1227
Jaunpur	1176	1283
Ballia	1108	1307
Ghazipur	1074	1154
Varanasi	1366	1279
Mirzapur	951	985

Table V.7 gives the land productivity in terms of money value for all the districts of the region for 1960's and 1970's. There are as many as six districts in the region which have recorded decline in the per hectare productivity of land, two in the Bihar plains and four in the U.P. plains. In the former one, Purnea recorded the largest decline where the per capita productivity fell from Rs.1252 in 1960's to Rs.1037 in 1970's. In the U.P. plains Gorakhpur recorded the largest decline.

Munger, Saharsa, Sultanpur and Mirzapur have shown very marginal improvement in land productivity. The districts of Saran and Champaran in the north-west of the North Bihar plains, and Bhagalpur in the south of the river Ganges, recorded the largest increase in the land productivity, the absolute increase in these two districts being Rs.613, Rs.475 and Rs.461, respectively. The rest of the districts have shown either very low or medium increase over the period.

LABOUR PRODUCTIVITY: The above discussed method however does not take into account the growing size of labour force involved in agricultural practices. Since the labour productivity is worked out in terms of the total output per unit of labour, it is a very good

Table V.6: Districtwise Labour Productivity & Man-Land Ratio

Districts	Labour Productivity (in Rs./per hect.)		Man-Land Ratio	
	1960's	1970's	1960's	1970's
Patna	1480	1219	0.84	0.65
Gaya	1420	976	0.95	0.73
Shahabad	1017	1013	1.21	0.96
Saran	890	973	0.70	0.55
Champaran	1036	1182	0.84	0.69
Muzaffarpur	685	597	0.68	0.50
Darbhanga	726	592	0.68	0.48
Munger	842	599	0.78	0.55
Bhagalpur	842	982	1.03	0.65
Saharsa	842	599	0.78	0.55
Purnea	1195	738	0.95	0.71
Allahabad	943	986	0.97	0.90
Gonda	870	877	0.90	0.80
Faizabad	1031	972	0.78	0.70
Sultanpur	1006	943	0.80	0.82
Partapgarh	839	825	0.86	0.85
Basti	917	976	0.76	0.69
Gorakhpur	973	1017	0.61	0.70
Deoria	1168	1158	0.73	0.66
Azamgarh	1059	965	0.83	0.79
Jaunpur	965	999	0.82	0.78
Ballia	1021	1000	0.92	0.77
Ghazipur	1047	1027	0.97	0.86
Varanasi	1319	1072	0.97	0.84
Mirzapur	1317	1095	1.38	1.11

indicator of standard of living in a region.[1] In the surplus labour region the labour productivity is usually very low, and further increase in the number of workers further deteriorates the condition.

The simplest form of working out the labour productivity is to divide the money value of the total output by the number of the workers. Here we have worked out the labour productivity of all the districts taking these two variables. It is evident from the Table V.8 that the labour productivity has been very low at both the two points of time, and that too, during this period of ten years it has further declined in majority of the districts. The largest decline is witnessed in Purnea district. It may be seen that it was this district where largest decline in land productivity was witnessed. Eight districts in the Bihar plain and ten districts in the U.P. plains have shown fall in the labour productivity. There are only seven such districts which have shown increase, and they are: Saran, Champaran and Bhagalpur (in the Bihar plains), and Allahabad, Gonda, Basti, Gorakhpur and Jaunpur (in the U.P. plains). Except Gorakhpur, all the other districts have shown increase in the land productivity also. The largest increase was

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1. Yates, P.L., Food Land Manpower in Western Europe, London, 1960, p.149.

reported in Champaran.

It is evident from the same table that in all the districts except Gorakhpur, the man-land ratio has declined considerably. In Gorakhpur man-land ratio has increased slightly from 1960's to 1970's and it is this reason that even the land productivity has declined the labour productivity has improved slightly.

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CHAPTER VI

INTERRELATIONS BETWEEN DEMOGRAPHIC AND AGRICULTURAL VARIABLES

In the last two chapters we have studied the salient features of changes taken place in both demographic and agricultural variables during the period from early 60's to early 70's. As stated earlier in the present chapter we shall discuss the interrelationship between these two sets of variables, and this is the main objective of the present study. The interrelations have been established with the help of simple correlation analysis. The regression analysis, however, could not be used, because of the problems involved in the identification of dependent and independent variables. It is generally accepted that at one point of time a variable or a set of variables may operate as dependent variables while at different point of time they become independent ones. Even at a particular stage both may operate as dependent and independent variables simultaneously. As stated somewhere in the beginning the relationships between population and economy is bi-directional one.

While discussing the changes occurred in the demographic as well as agricultural scenes, we discussed these aspects in detail taking many variables from both the aspects. But

while establishing the relationship between them it is found that many of the variables are not that important to exert direct influence on the other set. Moreover, our main purpose here is to see the response of population change on the agricultural development and vice-versa. Hence in the present chapter many of the variables have not been included. The following variables have been chosen for the present chapter:

i) Population growth rate,
ii) growth in agricultural workers,
iii) changes in dependency ratio,
iv) growth in gross cultivated area,
v) growth in net cultivated area,
vi) growth in land productivity,
vii) growth in labour productivity, and
viii) growth in agricultural output.

With the help of these variables we shall test the hypotheses developed in the last few sections of the first chapter of this study. It will be noticed in the proceeding sections the above selected variables are adequate enough to provide sufficient scope in testing the hypotheses and establishing the nature of interrelationship between the two aspects - demographic and agricultural.

Hypotheses:

The first hypothesis relates to the expected positive correlation between growth in population and agricultural workers on the one side and gross and net cropped areas on the other. The rationale behind this hypothesis is that in an agricultural backward region like 'Middle Ganga Plain', with growing pressure on land, extension in agricultural land takes place through increase in net cropped area and not through multiple cropped area. In fact multiple cropping requires improvements in infrastructural facilities such as irrigation, fertiliser consumption etc. This region has not experienced very notable improvement in such facilities. Hence the extension in the net cropped area would be much prominent and is likely to have positive significant correlation with growth in population in general and agricultural workers in particular.

The second hypothesis stated that there would be significant inverse relationship between population growth and growth in the agricultural productivity levels - viz. land productivity. In fact with increase in population, more and more areas are brought under net cultivation to meet the growing demand of food and to absorb the growing size of workforce. But this extension of 'net

cropped areas' is not usually accompanied by extension of irrigation, increase in fertiliser consumption and introduction of improved techniques to exploit the land. As a result of all these, though the total volume of agricultural products may increase, the productivity levels shows secular decline. In other words, there is all possibility of significant negative correlation between population growth and growth in land and labour productivity.

The third hypothesis is the further elaboration of the two mentioned above. A large part of the growing workforce is not gainfully employed in agriculture, because of declining levels of productivity. In such cases people, generally in the working ages tend to to outmigrate. This outward migration of the working population is more prominent when the labour productivity shows drastic decline. The outmigration will result in increase in dependency ratio, since the size of dependent population becomes larger in relation to the economically active population. So the third hypothesis says there would be negative correlation between increase in dependency burden and growth in the levels of productivity.

Test of hypotheses:

The intercorrelation among the variables has been presented in Table VI.1. It can be seen that there exists

Table VI.3: Intercorrelation Between the Selected Variables

Sl. No.	Variables	1	2	3	4	5	6	7	8
1.	Population Growth	1.0000							
2.	Growth in Agr. Workers	.7056*	1.0000						
3.	Dependency Ratio	.0118	-.1967**	1.0009					
4.	Gross Cropped Area	.4462*	.2051**	-.0151	1.0000				
5.	Net Cropped Area	.6516*	.2559*	0.1234***	.6901*	1.0000			
6.	Land Productivity	-.1355***	.1022	-.1181***	.0227	-.3569*	1.0000		
7.	Labour Productivity	-.4385*	-.5603*	.0483	-.0368	-.3250*	.4597*	1.0000	
8.	Agricultural Output	.1050	.3110*	-.0145	.0281	-.0650	.6898*	.7105*	1.0000

* Significant at 1 per cent level of significance.
** Significant at 5 per cent level of significance.
*** Significant at 10 per cent level of significance.

Figures having in astrick marks are not significant.

a very significant positive correlation growth in population and agricultural workforce (on the population side) and growth in gross and net cultivated areas. Two important features appear to be worth mentioning. The first being the fact that extension of area shows much stronger correlation with population growth than growth in agricultural workers, but, however, in both the cases the correlations are equally significant. Secondly, the extension of 'net cropped area' shows much stronger correlation than what is seen in the case of 'gross cultivated area', the latter one also includes the contribution of increase in double cropped area. These characteristics of the correlation justify our first hypothesis that the increase in population is largely responded by extension in 'net cropped area'.

Again it can be seen that the growth in population is having negative correlation with growth in productivity levels. However, this inverse correlation is much more significant in the case of labour productivity, which is a usual phenomenon. The growth in agricultural output does not show any significant correlation with population. This also justifies our second hypothesis. Nevertheless, the growth in agricultural workers shows a very significant positive correlation with growth in agricultural output, though it is having prominent inverse relationship with labour productivity.

Now let us examine our third hypothesis, by seeing the relationship between dependency ratio and productivity levels. It is noticed that dependency ratio and labour productivity do not represent any significant correlation between them, though with land productivity it shows a inverse correlation at 10 per cent level of significance. Hence we can say that our third hypothesis does not stand true here, since this simple linear correlation coefficient does not represent any relationship between them. It can be assumed that the fall in the labour productivity does not lead to any remarkable age-selective migration in the region, but instead of that whole family or household must be migrating, as has been seen in some districts where both population growth rate and dependency ratio have been very low. In those cases the low growth in population cannot be ascribed to fertility and mortality alone.

By now we have seen the relationship between some of the important variables from population and agriculture for the region as a whole. But the spatial trend in the relationship are equally important to be looked into. The correlation analysis gives the extent and nature of relationship through an average figure only. For this detailed insight let us study the Table VI.2.

Table VI.2: Districts in various categories[1] rates of growth in population, agricultural workers, Gross Cultivated land productivity and agricultural output (1961-71)

	Districts	Population (Rural)	Agr. Workers (Male)	Gross Cropped Area	Land Productivity	Agr. Output
1.	Patna	IV	I	V(n)	III	III
2.	Gaya	I	II	V(n)	V(n)	V(n)
3.	Shahabad	II	II	V(n)	II	II
4.	Saran	II	II	IV(n)	I	I
5.	Champaran	III	III	I	I	I
6.	Muzaffarpur	IV	II	III	I	N.A.
7.	Darbhanga	II	I	I	III	IV
8.	Munger	V	II	V(n)	IV*	V(n)
9.	Bhagalpur	I	I	IV*	I	I
10.	Saharsa	I	I	I	IV*	V(n)
11.	Purnea	I	I	II	V(n)	V(n)
12.	Allahabad	II	IV	III	II	II
13.	Gonda	V	IV	IV(n)	II	III
14.	Faizabad	IV	IV	V(n)	III	III
15.	Sultanpur	IV	IV	II	IV*	III
16.	Partapgarh	V	V	III	IV*	IV
17.	Basti	V	V	II	II	II
18.	Gorakhpur	III	III	II	V(n)	I
19.	Deoria	III	V	I	III	II
20.	Azamgarh	III	V	III	V(n)	IV
21.	Jaunpur	IV	V	II	II	III
22.	Ballia	III	III	III	I	II
23.	Ghazipur	V	IV	I	III	I
24.	Varanasi	II	III	IV	V(n)	V(n)
25.	Mirzapur	I	III	IV(n)	IV	IV

N.A. - Not available.

(n) - refers to negative changes occurred.

* - marks refer to very small changes.

1. Categories I to V correspond to very high, high, medium, low and very low respectively.

Here in this table all the districts have been classified under five categories for each of the variables by arranging them in descending order. The categories I to V represent very high, high, medium, low and very low rate of changes in such variables as population growth, growth in agricultural workers, changes in land and labour productivity, growth in gross cultivated area and agricultural output etc. It is here that a spatial trend in the changes occurred in two sets can be assessed. Though it is very difficult to quantify the extent to which both the two - population and agriculture respond adequately, yet some idea can be had as to which are the probable areas where the agriculture has failed completely to support the growth in population, where they have gone side by side etc. etc. It should be again kept in mind that assigning 'very high' category to any district we simply mean that a particular district has experienced larger growth in a particular variable in comparison to other districts of the region. In the other categories of most of the agricultural variables, many districts have recorded even negative changes.

During the period of ten years the districts of Bhagalpur, Purnea, Gaya and Saharsa, in Bihar and Mirzapur in U.P. recorded 'very high' growth in the population. In

the case of Bhagalpur, Saharsa and Purnea, the growth in the agricultural workers was equally 'very high' and in the rest two it was 'high' and 'medium'. As against this the growth in the total cropped recorded 'very high' growth only in the district of Saharsa. In Purnea it was 'high' and in the rest three it was either 'low' or 'very low'.[1] The position of these districts is even worse in the case of changes taken place in productivity level and output. Here except Bhagalpur all other districts recorded either low or very low changes in total agricultural production and production per unit of land. Bhagalpur recorded equally 'very high' growth in both land productivity and agricultural output. Bhagalpur is the exception to the correlation found between population growth and growth in agricultural productivity and output. It is more striking to note that in Gaya and Purnea recorded negative changes in both. Saharsa which showed negative change in the land productivity however recorded very insignificant change in the agricultural output. These two districts come very true to the correlation established earlier.

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1. Of these three Bhagalpur showed very insignificant change, while Gaya and Mirzapur recorded negative growth.

The next category of change in population comes of 'high' growth, and in this category fall the districts of Shahabad, Saran, Darbhanga, Allahabad and Varanasi. In Shahabad and Saran the growth in workers engaged in agriculture has also maintained the same level, while in Darbhanga it has reported 'very high' growth in it. It seems due to lack of other sectors, the growing population found its more and more way into the agricultural activities. As contrary to this one, Allahabad and Varanasi recorded 'low' or medium growth in their agricultural workforce. In fact the better changes of economic activities in the surrounding urban areas of these districts must have diverted some of the increase in the manpower from the rural areas. Again except Darbhanga, in other three districts the changes in gross cropped area have been from 'medium' to 'very low'. Darbhanga records 'very high' growth. Here in this district it seems, the total cropped area has more clearly responded to population growth. Shahabad and Saran have reported negative growth. Allahabad and Varanasi experienced 'medium' and 'low' growth in the total or gross cropped area. Out of these districts Varanasi, however, showed negative growth in both land productivity and agricultural output. Saran showed very high growth in both agricultural output and land productivity. Shahabad and Allahabad have maintained the same category

in terms of growth in output and productivity.

Champaran, Gorakhpur, Deoria, Azamgarh and Ballia come in the third category in terms of population growth. In the case of Champaran, Gorakhpur and Ballia the growth in agricultural workers has shown the same ranks, while in the rest two there has been 'very low' growth in it. When the changes in gross cropped area is seen it is found that Champaran and Deoria recorded 'very high' growth and in the rest, it is either 'medium' or 'high'. In spite of the fact that in Gorakhpur productivity level has declined, the agricultural output records 'very high' growth. Champaran showed 'very high' growth in both productivity and agricultural output. In the rest of the districts, too, the condition is not that bad, except, in Azamgarh where there is 'low' growth in agricultural output.

The districts recording low growth in population and occupying fourth category in the rank are - Patna, Muzaffarpur, Faizabad, Sultanpur and Jaunpur. In terms of growth in agricultural workers Patna and Muzaffarpur recorded first and second category ('very high' and 'high') respectively, whereas in the rest, there has been growth of the same levels to that of population. It is an interesting point to note that all these

districts here recorded medium growth in agricultural output and growth in land productivity also shows almost the same trend. Patna and Faizabad have shown negative growth in the total cropped area, Jaunpur and Sultanpur have recorded 'high' growth and in Muzaffarpur it is 'medium' category. Jaunpur and Sultanpur experienced this 'high' growth in total cropped area inspite of the fact that population growth was 'low'.

In the last category of population growth are the districts of Munger, Gonda, Partapgarh, Basti and Ghazipur. In these districts while the growth of population was 'very low', the growth in agricultural workers has been much faster at least in three districts. Munger recorded 'high' growth in workers and both gross cropped area and agricultural output recorded negative change, though the land productivity changed slightly. Here the gross cropped area completely failed to respond to the growth in agricultural workers and the result is seen in the decline in agricultural output. As against this in Basti and Ghazipur, the growth in total cropped area is much faster. Ghazipur records very high increase in agricultural output. In terms of agricultural output the next position is held by Basti which recorded 'high' growth. Gonda and Partapgarh recorded 'medium' and 'low' growth in agricultural output.

This comparative picture can be concluded by the identification of 'surplus' and deficit producing districts as suggested by Mitra.[1] He identified around twelve of these twenty five districts which were food deficit districts in the year 1971. They are - Patna, Gaya, Deoria, Faizabad, Ballia, Darbhanga, Muzaffarpur, Munger, Saharsa, Varanasi and Partapgarh. Of these Gaya, Darbhanga, Saharsa and Varanasi are the districts which recorded either 'very high' or 'high' growth in their population and there are even more (numbering five) districts which recorded the same growth in the agricultural workers. The rest of the districts were identified as food surplus districts. No need to say that these remaining districts comprise a majority of those which recorded a balanced growth in their population and agricultural production.

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1. Mitra, Asok, "Country Monograph Series No.10", Population of India, Table No.198, ESCAP-UN, New York, 1982.

CONCLUSION

The present study explores the nature of relationship between population growth and agricultural development in 'Middle Ganga Plain' for the period from early 60's to early 70's. Middle Ganga Plain occupying a vast area in the north Indian plains and comprising a sizeable population, basically rural, is predominantly an agricultural region, where a little less than 90 per cent of total work-force of the rural population is engaged in agricultural activities.

During the period of ten years, from 1961 to 1971, the total population jumped from 62 million to 74 million. Of this the rural population comprised of nearly 57.03 million and 67.58 million at the two points of time respectively. The growth rate in the decade was around 18.49 per cent. This growth rate, however, showed considerable amount of regional variation. On an average, the Bihar plains recorded much larger rates of increase than their counter-parts in the U.P. plains. There are as many as seven districts which recorded larger growth rate than the average in the Bihar plains, while the same, numbers only three in the U.P. plains. While on the one hand Saharsa in the extreme east recorded a growth of more than 35 per cent, Gonda in the north-west of east U.P. plains increased

its population with a rate of a little more than 10 per cent. In fact it is very interesting to note than despite is large variation, the geographic distribution of population is not further concentrated. As noticed in Gini's Co-efficient and Lorenz Curve, this accentuation of population concentration has further been lessened, though very marginally. Exactly the same trend was noticed in the growth of rural male workers and workers engaged in agriculture. Even though the workforce participation rate has declined through out the region over the period, and a part of it can be attributed to the definitional changes in the concept of workers, the absolute figures showed tremendous growth. The rate of growth in agricultural workers has been much larger than the average growth in the total workers, which shows the growing dependence on agriculture. The share of workers engaged in agriculture has increased from 82.34 per cent to 88.02 per cent.

As against these, when we evaluate the changes taken place in agriculture we come to a very alarming conclusion. During the period of this ten years the agriculture has not at all shown any dynamism and remained almost stagnant. The area under crops which is the first thing to be looked into has increased with a rate of merely 2 per cent. Total cropped area is increased through two ways. First, Net cropped area, which has increased very marginally. Another

way of increasing the agricultural area is through intensive cultivation by bringing more and more lands under multiple cropping. In twelve of the districts the area under multiple cropping has recorded further decline and on average there has been a very marginal change in the percentage share of multiple cropped area in the net cropped area. The result of this decreasing total cropped or very marginal increase on the one hand and tremendous growth in the agriculture labour force, has been in constant decline in man-land ratio through out the region. In the absence of any satisfactory increase in the total cropped area, the growing population pressure can be taken care of by improvements in the yields.

The extension of irrigation, increase in fertiliser consumption, use of high yielding varieties etc. coupled with improved agronomic practices, pesticides, soil improvement, can prove to be the most fruitful means of overcoming the problems arising out of the growing pressure of man on land and demand of food. As far as the questions of extension of irrigated area and fertiliser consumption are concerned, it was noticed that they have shown improvements to some extent. The per hectatre consumption of chemical fertiliser has improved considerably. Inspite of all these not much improvement is seen in the productivity levels and the agricultural output in the

region, as we shall see in the next paragraph.

The combined effect of all these can be noticed in the changes in the levels of productivity and agricultural output. The labour productivity has declined considerably in majority of the districts over the period, which clearly indicates the growing pressure on lands and the inefficiency of agricultural sector. There are only four districts, out of twenty five, namely: Saran, Champaran, Bhagalpur and Allahabad which have recorded some increase in the labour productivity. This reveals the deteriorating conditions of the standard of living of masses in the region. Land productivity has somehow recorded increase at the rate of around 8 per cent. The changes taken place in the agricultural output during this period shows again a large range of variation. There are as many as five districts which have reported considerably decline in the total agricultural output and there are around six districts which showed very marginal changes. This, if seen in relation to the changes taken place in the population and agricultural labour force, presents a very alarming situation. It is found that out of the five districts which recorded decline in output, as many as four of them recorded either 'very high' or 'high' rates of growth in their population. These districts are: Saharsa, Varanasi, Gaya and Purnea.

As against this out of the five districts which recorded very high growth in output, three, namely: Ghazipur, Champaran and Gorakhpur, have recorded either 'medium' or 'very low' rate of growth in the population. Similarly of the districts recording marginal change in the output, two: Darbhanga and Mirzapur recorded either 'high' or 'very high' rates of growth in population. As suggested by Asok Mitra, around thirteen of these twenty five districts are food deficit districts and they are: Patna, Deoria, Gaya, Faizabad, Ballia, Azamgarh, Darbhanga, Muzaffarpur, Munger, Saharsa, Purnea, Varanasi and Partapgarh. It can be seen here that a majority of these districts have recorded high growth in population and agricultural labour force.

Though, there are large variation in the rate of increase in the net area sown, they well correspond to the population growth and hence the coefficient of correlation between population growth and net area sown was found to be very high and positive. This reveals that the growing population pressure is largely responded by increase in net area sown rather than double cropped area. This is a typical characteristic feature of an agriculturally backward area. It was again seen with the help of correlation coefficient that, since the growth in area is usually not accompanied by improvement in

infrastructural facilities, there was negative correlation of population growth with productivity levels and output. These two hypotheses were validated in this study. However, no significant correlation was found between the dependency burden of the population and changes in productivity levels, especially labour productivity, which was done to see if there was any outward migration of population under working age-groups. It can't, however, negate the fact that the region is predominantly an outmigrating area. Migration is prevalent but it is not strictly age-selective in nature. People in the non-working groups or whole family must be involved in such spatial mobility. This was our third hypothesis which was rejected.

At this point it can't be claimed that the present work has been able to explain the existing interrelations between population and economic development in toto. There were many issues which were left untouched either due to the limited scope of time and space or due scarcity of detailed data. There are possibilities of some shortcomings also. In future I hope some effects would be made to fill these gaps up.

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APPENDIX 1(A)

Total Rural Population, Male Population, Total Male Workers and Agricultural Male Workers - 1961

Districts	Total Population	Total Population	Total Workers (Male)	Agricultural* Workers (Male)
Patna	2355850	1195162	634390	436454
Gaya	3382794	1672194	907197	740520
Shahabad	2986316	1491194	797999	597708
Saran	2435002	1597657	794779	668704
Champaran	2860566	1440285	844622	735268
Muzaffarpur	3929573	1905263	1038926	884071
Darbhanga	4222472	2040084	1097079	901195
Munger	3011883	1505592	831137	638702
Bhagalpur	1524417	775110	434432	319621
Saharsa	1656139	846831	485468	391714
Purnea	2903531	1499629	882118	692607
Allahabad	1994412	104957	597632	483642
Gonda	1971981	1017629	648094	581602
Faizabad	1491572	746490	441332	386630
Sultanpur	1386903	686093	401528	348275
Partapgarh	1230799	595530	333852	286207
Basti	2588658	1326409	828500	754904
Gorakhpur	2377839	1191052	698974	614675
Deoria	2317498	1154677	660593	605201
Azamgarh	2292879	1123748	610468	516588
Jaunpur	1635839	769572	424821	363215
Ballia	1285622	628529	332998	261066
Ghazipur	1276424	630506	339451	271102
Varanasi	1809033	905879	492681	346796
Mirzapur	1105926	566131	338819	261218

* Addition of the two categories of Census economic data viz. 'Agriculture Labourers' and 'Cultivators'.

APPENDIX 1(B)

Total Rural Population, Male Population, Total Male Workers and Agricultural Male Workers - 1971

Districts	Total Population	Male Population	Total Workers	Agricultural Workers
Patna	2755152	1425980	711425	606346
Gaya	4117468	2079507	1051477	915602
Shahabad	3615151	1847599	905282	762425
Saran	4099721	1989273	947857	844426
Champaran	3358392	1734364	977610	896857
Muzaffarpur	4586719	2294650	1234314	1117645
Darbhanga	5001900	2513425	1337482	1201166
Munger	3430544	1764492	926704	808618
Bhagalpur	1859235	970837	506322	440961
Saharsa	2243793	1165471	646082	588168
Purnea	3691819	19144520	1077367	958502
Allahabad	2395175	1244391	634986	532197
Gonda	21271913	1156396	695118	647481
Faizabad	1743099	898825	480451	428218
Sultanpur	1610598	816236	427630	380298
Partapgarh	1394798	690614	399290	297644
Basti	2908791	1525851	882099	808614
Gorakhpur	2798019	1447399	771304	685113
Deoria	2729241	1390409	722167	654244
Azamgarh	2708617	1351911	644787	558805
Jaunpur	1880872	930547	431652	376452
Ballia	1516175	765255	356817	299822
Ghazipur	1462654	737862	354943	298567
Varanasi	2135685	1100990	533747	390966
Mirzapur	1355703	705068	372856	320416

APPENDIX 2

Distribution of Rural Male Population in Broad-age groups

Districts	1961			1971		
	0-14	15-60	60+	0-14	15-60	60+
Patna	509578	605793	79198	615306	710118	100049
Gaya	729498	834718	107387	921354	1015776	142269
Shahabad	642118	752825	95809	809578	908194	129281
Saran	769789	727113	100404	933898	921335	133989
Champaran	606405	765825	67717	728702	913477	92118
Muzaffarpur	858283	937281	109144	1000367	1142310	151890
Darbhanga	931952	1006677	101034	1094260	1279140	139942
Munger	661862	753535	89939	757998	892587	113860
Bhagalpur	336090	392833	45592	422566	484360	63859
Saharsa	384728	425648	38245	518120	593829	61466
Purnea	656419	774406	67924	867426	995364	101518
Allahabad	432184	523829	58535	557779	607311	79197
Gonda	402286	552235	62748	483410	663312	80705
Faizabad	312323	383363	50515	381251	450387	67119
Sultanpur	288967	349602	47332	349733	404889	61614
Partapgarh	264680	289101	41202	315381	322179	53041
Basti	531673	706577	82118	612510	805275	108024
Gorakhpur	501705	618872	70072	608579	741813	96965
Deoria	500049	584589	69719	604720	693296	92383
Azamgarh	514914	533430	74925	555906	636381	159575
Jaunpur	367049	371559	50555	433455	435045	62009
Ballia	283112	298203	47027	320455	386549	58251
Ghazipur	285101	297599	47675	335416	339254	63101
Varanasi	399524	451831	54377	474556	548827	77566
Mirzapur	233553	302245	30183	309017	348502	47528

APPENDIX 3 (A)

Average Area under Some Major Crops 1969-72

Districts	Rice	Wheat	Maize	Gram	Tur	Sugarcane	Barley	Negi
Patna	205346	92359	36499	30309	7328	4568	6036	1591
Gaya	480613	123750	18654	31453	7035	12404	10166	9107
Shahabad	483711	291488	13093	52088	7866	10569	16074	526
Saran	190259	136841	128533	12570	26495	22757	45828	7619
Champaran	427316	136082	40102	2140	10400	53460	45664	1383
Muzaffarpur	316616	74741	86810	5720	11773	13164	38853	9796
Darbhanga	408688	90304	85668	8089	12793	14856	16529	20359
Munger	147384	135984	165996	14198	10147	2401	13480	2261
Bhagalpur	158066	45706	63772	43338	3735	5197	15793	444
Saharsa	183862	64673	55537	717	1658	1078	9407	14784
Purnea	478858	83320	36936	11130	1878	1724	13791	1961
Allahabad	157582	98445	1611	64384	21809	5509	77491	3319
Varanasi	138142	59147	12500	29285	21142	18229	49529	624
Mirzapur	138402	65821	17279	38082	18422	4838	42521	91
Jaunpur	88718	48663	59347	10573	11165	18314	77992	635
Ghazipur	135120	38179	7511	29734	22159	21256	52568	188
Ballia	74186	43048	24146	33892	13302	19258	40175	293
Basti	337218	194529	20299	19235	1042	30326	42576	642
Gorakhpur	256923	169608	9945	17549	3159	24585	43521	293
Deoria	186362	178149	26180	11471	5612	72195	41799	1784
Azamgarh	208991	56009	21665	20395	24416	39322	99625	242
Faizabad	140189	69424	11429	35599	6768	25777	20555	1233
Gonda	236464	142951	95393	41300	4401	25965	25561	575
Sultanpur	153669	58395	9056	38674	16859	10660	36522	957
Partapgarh	87151	29577	2445	19436	18228	4303	51589	8052

APPENDIX 3 (B)

Average Area under some important Crops
(1959-62)

Districts	Rice	Wheat	Maize	Gram	Tur	Sugarcane	Barley	Ragi
Patna	249974	47003	24143	52424	3216	6674	11284	3670
Gaya	496062	94720	15240	67567	10039	13130	20065	14159
Shahabad	479132	136994	15387	123513	14175	13944	23076	974
Saran	197967	76625	113952	23394	35290	37430	76560	9895
Champaran	388082	45934	38482	11747	11706	52324	67849	1987
Muzaffarpur	303201	44234	81382	12888	15920	21990	56073	15297
Darbhanga	345462	40770	63637	18592	17379	22928	33037	385100
Munger	203178	83457	131193	89230	16117	6763	24102	7936
Bhagalpur	156567	20283	59298	39760	4932	5457	17047	720
Saharsa	99801	20793	47961	2061	2477	652	20995	21302
Purnea	430696	32632	54827	20790	4209	995	30325	4638
Allahabad	145479	54231	537	97808	27394	6074	86951	3275
Varanasi	140612	97995	9816	40175	19833	18221	58843	590
Mirzapur	132290	44243	12173	51235	21175	5103	52477	133
Jaunpur	96381	26974	40588	13180	11727	18006	88705	964
Ghazipur	91976	15814	4099	37463	17756	13270	55360	54
Ballia	69937	20323	20049	39299	18949	16597	50996	348
Basti	294641	113839	22692	37994	821	33046	81848	157
Gorakhpur	232637	83655	9953	24216	3395	25898	91935	159
Deoria	166973	73860	22036	12381	7556	80464	61815	3762
Azamgarh	193432	21982	17037	24481	15480	37077	108104	450
Faizabad	131685	67669	8319	57188	5321	21570	31302	51
Gonda	238859	133521	101910	51698	3086	25853	36586	76
Sultanpur	126216	43432	4610	49202	9556	9851	37780	549
Partapgarh	79512	28037	2365	23220	23904	4249	52781	5000

APPENDIX C

Total Cropped Area, Area Sown More than once, Net Area Sown and Net Irrigated Area. 1959-62 and 1969-72

Hectares:

Districts	Total Cropped Area		Area Sown More than once		Net Area Sown		Net Irrigated Area	
	1960's	1970's	1960's	1970's	1960's	1970's	1960's	1970's
Patna	645809	617561	229019	201651	421837	415909	271498	261853
Gaya	1040756	948262	352587	223531	688169	724398	527667	558637
Shahabad	1163977	1125005	472395	368705	691622	756300	477037	508486
Saran	663658	650702	169893	167532	493778	483169	77740	140608
Champaran	773240	804542	158434	276331	614537	618187	78410	160586
Muzaffarpur	707027	778648	132923	207112	601673	571536	25052	35940
Darbhanga	738161	817709	148246	210356	590326	607352	13835	60829
Munger	727902	611576	157650	144382	570109	467194	133305	131780
Bhagalpur	334661	395923	71301	104078	323360	291845	76164	107978
Saharsa	353416	473019	62923	134716	270493	344302	11138	51540
Purnea	805783	937282	263065	249235	622718	694047	2561	61364
Allahabad	602108	618993	127139	137753	474969	481240	107205	133953
Varanasi	454674	455539	119998	119714	334606	335825	155099	166441
Mirzapur	475067	468606	115976	103016	359891	365590	81950	95507
Jaunpur	373300	388050	75703	90886	297597	297164	154599	154702
Ghazipur	320314	310230	59715	71383	260799	238847	95607	104945
Ballia	304355	310855	64790	76020	239564	234835	83683	99700
Gorakhpur	632418	651259	156006	1700212	476412	481047	177250	223161
Deoria	562520	524894	120483	185131	442033	439783	153043	197037
Basti	758119	724255	180900	230704	569758	563462	248803	300274
Azamgarh	541723	556109	108804	114169	432919	441941	216432	233019
Faizabad	425119	403358	124179	102073	300940	301283	149039	156862
Gonda	739972	724424	219951	204410	520322	520005	131264	135343
Sultanpur	391915	404110	94905	92944	297166	311165	11834	130554
Partapgarh	301705	309802	64800	58407	236904	251315	91025	98134

APPENDIX 5

Fertiliser Consumption 1959-62 & 1969-72

Districts	Nitrogenous		Phosphatic		Potassic		Total	
	1960's	1970's	1960's	1970's	1960's	1970's	1960's	1970's
Patna	3706	9782	275	1425	-	830	3981	12037
Gaya	1548	6065	94	959	-	497	1642	7521
Shahabad	1280	15903	323	5037	-	1175	1611	22115
Saran	539	9576	190	1282	-	847	729	11705
Champaran	260	6727	431	3927	-	1813	691	14467
Muzaffarpur	310	5331	215	679	-	518	525	6528
Darbhanga	315	5072	159	726	-	564	475	6362
Munger	478	5970	52	1486	-	629	530	8084
Bhagalpur	798	1844	43	608	-	118	841	2570
Saharsa	20	2403	17	905	-	309	37	3657
Purnea	63	1586	26	831	-	395	89	2812
Allahabad	962	8235	50	1723	-	651	1012	10609
Varanasi	802	9464	51	2199	-	1905	853	13568
Mirzapur	353	2468	35	800	-	601	388	3869
Jaunpur	411	6776	98	1923	-	1471	509	10170
Ghazipur	403	3872	49	1207	-	844	492	5923
Ballia	165	3679	47	1074	-	831	212	5584
Gorakhpur	801	12767	146	2935	-	1463	947	17166
Deoria	904	12749	90	3809	-	2536	994	19094
Basti	635	14204	-	3947	-	2457	635	6869
Azamgarh	17	7310	30	1847	-	1209	47	10366
Faizabad	840	11062	33	3866	-	2298	873	16426
Gonda	205	9420	43	3579	-	2989	249	15988
Sultanpur	227	5753	11	1870	-	1424	238	9047
Partapgarh	268	3751	70	1286	-	880	338	5917

APPENDIX 6

Land and Labour Productivity and Man-Land Ratio
1962-65 and 1970-73

	Production/ Worker		Production Hectare		Man-Land Ratio	
	1960's	1970's	1960's	1970's	1960's	1970's
Patna	1219	1480	1874	1754	.6510	.8436
Gaya	976	1420	1336	1488	.7300	.9844
Shahabad	1613	1817	1673	1506	.9330	1.2066
Saran	973	890	1776	1163	.5480	.7052
Champaran	1182	1036	1706	1231	.6930	.8416
Muzaffarpur	597	685	1192	1002	.5010	.6833
Darbhanga	592	796	1230	1170	.4810	.6806
Munger	599	842	1091	1085	.5480	.7760
Bhagalpur	982	842	1522	1061	.6460	1.0295
Saharsa	599	842	1091	1085	.5480	.7760
Purnea	738	1195	1037	1252	.7120	.9546
Allahabad	986	943	1098	970	.8970	.9716
Gonda	877	870	1100	968	.7970	.8985
Faizabad	972	1031	1398	1329	.6950	.7762
Sultanpur	942	1006	1154	1146	.8160	.8775
Partapgarh	825	839	973	979	.8450	.8574
Basti	976	917	1416	1214	.6890	.7551
Gorakhpur	1017	973	1446	1590	.7040	.6118
Azamgarh	965	1089	1227	1284	.7860	.8340
Jaunpur	999	965	1283	1176	.7790	.8209
Ballia	1000	1021	1307	1108	.7650	.9212
Ghazipur	1027	1047	1154	1074	.8620	.9749
Varanasi	1072	1319	1279	1366	.8390	.9654
Mirzapur	1095	1317	985	951	1.1110	1.3847

APPENDIX 7

List of Crop-wise Prices used for Computation of Total Agricultural Output*

(1970-73 prices)

Crop	Prices (Rs. 1 tonne)
Rice	1158.97480
Wheat	813.00532
Maize	648.74835
Ragi	716.79924
Barley	665.00000
Gram	983.12749
Tur	1194.04800
Sugarcane	1034.44120

Source: G.S. Bhalla and Y.K. Alagh, Performance of Indian Agriculture, Appendix 3, p.206.

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