

**Pattern of Agricultural Productivity and its
Determinants in Uttar Pradesh
(1960-63 — 1980-83)**

**Dissertation submitted to the Jawaharlal Nehru University
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NEW DELHI



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This is to certify that the dissertation entitled "PATTERN OF AGRICULTURAL PRODUCTIVITY AND ITS DETERMINANTS IN UTTAR PRADESH (1960-63-1980-83)" submitted by Mohd. Umar in fulfilment of six credits out of the total requirements of twenty four credits for the degree of Master of Philosophy (M.Phil) of the university, is, to the best our knowledge, a bonafide work and may be placed before the examiners for evaluation.

M.H. Qureshi
Supervisor 26.12.88

Gmhadha -
Chairman 2.1.89

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Chapter I

INTRODUCTION

India's economy is basically agrarian economy. The agricultural sector alone contributed 59 per cent of the national income in 1950-51, 54 per cent in 1960-61, 48 per cent in 1970-71 and 40 per cent in 1980-81. Being the largest industry, it is the source of livelihood for over 70 per cent population in the country. In other words seven out of every ten persons depended on agriculture. This proportion, is quite high and what is more remarkable is that between 1901 and 1971 this proportion has come down only marginally from 70 to 63 per cent.

This sector dominates the Indian economy to such an extent that a very high proportion of working population in India is engaged in agriculture. According to 1981 Census figures 59.4 per cent of working population in India was engaged in agriculture as compared to 69.7 per cent in 1971 and 69.5 per cent in 1961.¹ The importance of agriculture sector is further evident from the fact that it has been the source of supply of raw materials to some of our leading industries such as cotton and jute textiles, sugar, edible oil etc.

1. Figures are not really comparable because of change in definition and coverage; Assam and Jammu and Kashmir are not included in 1981.

In spite of great importance of agricultural sector in the economy of the country, the productivity level still remains low. The basic problem in the development of Indian agriculture is its dependence mainly on environmental factors. These physical environmental factors lay the broad framework for the crop growth, as the crops which grow biologically have specific agronomic requirements. The farmer tries to modify the parameters of physical environment through modern inputs, which, being income biased, are not available to all farmers. Hence, it has resulted in a great diversity in agricultural development. Such patterns become more complex when one consider the farmers personal characteristics particularly his knowledge of new developments in farming and agriculture as a dynamic process.²

The importance of agriculture in economic development has been debated upon since long. "The physiocrats extolled agriculture as the only part of the economy that produced a surplus above the current requirement of labour and capital employed." The fundamental physiocratic proposition was that the farm sector alone produced an economic surplus or net product over the cost of production and, therefore, it played most strategic role in a nation's economic development. The early classical economists made the productivity of agriculture

2. Mohammad, Noor (1978), Agricultural Land Use in India, Inter-India Publications, New Delhi, p.20.

the key to the size of country's population and, therefore, to considerable extent to the size of its entire economy. Modern economists also recognised the importance of agriculture.

1.1 Statement of the Problem

On an average 50 per cent of national income in India has been contributed by the agricultural sector. In spite of such a large proportion of its contribution to national income a majority of population is ill-fed and ill-health by the standards of what man has been able to accomplish in the prosperous nations of the world. In our country there is a need to improve both the quantity and quality of diet. To feed growing population with better quality diet, agricultural production should increase. Naturally the problem arises how to achieve an increased level of agricultural productivity in India. For this, the existing pattern of cropping, land-use, crop-yield and agricultural productivity level and role of their determining factors have to be examined, then predictions on agricultural productivity in future should be made.

The present study is an attempt to evaluate the existing pattern of crop-yield and agricultural productivity in the state of Uttar Pradesh. Nineteen important crops

which account for around 90 per cent of gross-cropped area of the state, have been taken for analysis at the three time periods in post-independence period.

1.2 Objectives of the Study

The major objectives of the study are as under:

- (1) To evaluate the levels of yield of important crops at the district level for the year 1960-63, 1968-71 and 1980-83
- (2) To examine and analyse the levels of agricultural productivity at district level and see its variations at the three periods of time 1960-63, 1968-71 and 1980-83.
- (3) To analyse the association of productivity with the inputs. This will be done both cross-sectionally, as well as between two points of time.

1.3 The Data Base

Data utilised for the study are collected from secondary sources only. For the output and input data the following publications have been referred to:

- (1) Season and Crop-Report of Uttar Pradesh (yearwise) published by Government of Uttar Pradesh.
- (2) Agricultural situation in India, published by Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.
- (3) Statistical Abstract of Uttar Pradesh (yearwise) published by Bureau of Statistics and Economics, Uttar Pradesh, Lucknow.

(4) Uttar Pradesh ke Krishi Ankre (yearwise), Government of Uttar Pradesh.

(5) Fertilizer Statistics (yearwise) published by Fertilizer Association of India, New Delhi.

For the prices the following publications have been referred to:

(1) Agricultural Prices of India, 1975-82, Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

(2) Weekly Bulletin of Prices, Week ending Friday (1981), Government of Uttar Pradesh.

1.4 Methodology

The following statistical methods have been used in the present study.

A) Agricultural productivity of a district has been computed by converting the production of each crop into money value at the constant price (1981) at the state level and aggregating the value of production under all nineteen crops³ and divided by the gross area under these crops in each district and thus deriving the value in rupees per hectare.

3. The nineteen crops: (1) Rice, (2) wheat, (3) barley, (4) jowar, (5) bajra, (6) maize, (7) gram, (8) Peas (9) Arhar, (10) Masoor, (11) Urad, (12) Mung, (13) Sugar-cane (14) potato (15) cotton, (16) Groundnut, (17) Sesamum (18) Lahie sarsoan, (19) tobacco.

B) For analysing the agricultural productivity trends from one period to another, annual compound growth rates have been computed in each district, with the help of following formula:

$$R = \frac{\text{Antilog}(\log X_2 - \log X_1)}{i} - 1$$

where R is annual compound growth rate of productivity, X_1 is the value of productivity during earlier period, X_2 is the value of productivity during later period and i is the interval between two periods.

C) Fertilizer consumption in terms of tonnes 1000 hectares has been computed by dividing the consumption value with the gross cropped area in each district in the state.

D) Irrigation in terms of per cent gross irrigated area to gross cropped area has been computed by dividing the gross irrigated area with gross cropped area and multiplied by hundred in each district.

E) Mechanisation Index in terms of Wpe/ 000 hectares, has been evolved by converting the irrigation machinery (diesel and electrical pumpsets), agricultural machinery (tractors) and iron and wooden ploughs into wooden plough equivalents with the help of a ratio among agricultural implements suggested by ICAR study.⁴

4. M.H.Qureshi and Ashok Mathur (1985), A Geo-Economic Evaluation for Micro-Level Planning, p.116.

F) Taking the productivity as a dependent variable and the other variables as independent, a stepwise regression programme was run in the computer for each time-period separately. The aim was to identify the respective share of the independent variables and the extent of explanation these offer in explaining the variations in agricultural productivity.

G) For the evaluation of yield pattern in the state, five major crops i.e., rice, wheat, barley, maize and sugarcane, have been selected. For each of these crops, the districtwise yield corresponding to 1960-63, 1968-71 and 1980-83, has been worked out by dividing triennial average of production with the average area under each crop.

1.5 Cartographic Methods

The spatial pattern of the dependent and independent variables have been depicted on the maps using the choropleth techniques by identifying suitable classes.

1.6 Overview of Literature

Agricultural productivity as a concept has been a highly debated term among agricultural economists, geographers and has different connotations in different parts of the world. A considerable amount of work has been done by various geographers and economists on the problems of agricultural

production, productivity levels, growth and various other aspects. Nevertheless, the review is confined to some of notable attempts related to agricultural productivity, its levels, growth and determinants.

T.W. Schultz has in his book, 'Economic Crisis in World Agriculture', emphasized the need to increase agricultural productivity. W.Arther Lewis⁵ depicted the importance of agriculture as follows: "Rising agricultural productivity supports and sustains industrial development in several important ways. Firstly it permits agriculture to release a part of its labour force for industrial development while meeting the needs of the non-farm sector. Secondly, it raises agricultural incomes, thereby creating the rural purchasing power needed to buy the new industrial goods and rural savings which may then be mobilised by direct and indirect means to finance industrial development. Finally, it enables agriculture to supply the major wage good (food) of industrial workers".

Other physiocrats like Benjamin Higgins, Professor Baur, P.V.John, S.R. Sen also recognised the importance of increased agricultural productivity in the overall development of a nation. It implies that increased agricultural productivity is the pivot on which the development of other

5. Lewis, W.A. (1955), Theory of Economic Growth, George Allen and Unwin, London, p.32.

sectors of economy revolve. Increased agricultural output and productivity will tend to contribute substantially to an overall economic growth of our country. Thus the basic question is as what does agricultural productivity really mean.

An increased agricultural productivity in the words of Sadhu and Singh,⁶ would mean "efficient use of inputs, which in turn lead to more food grains production to feed the teeming millions, higher income levels and better living of rural section of society and higher level of well being for the society as a whole".

According to George,⁷ "agricultural productivity contributes to economic growth, as agricultural needs of the economy are met not only with less labour but also with fewer total inputs per unit of output thus releasing excess resources for use in other sector".

Schwartzberg⁸ (1962) has made a pioneering attempt to identify and illustrate through maps the levels of economic development in India, taking into account the agricultural indicators of crop productivity, agrarian relations and

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6. Sadhu A.N. and Singh, A. (1980), New Agricultural Strategy: Its Implications, Marwah Publications, New Delhi, p.133.
 7. George, M.V. and Gangwar, A.C. (1973), Measurement of Agricultural Productivity - Some Conceptual Problems, Report of the activities of department of Economics, HAU, Hissar, p.15.
 8. Schwartzberg, J.E. (1962), "Three Approaches to the Mapping of Economic Development in India", Annals of the Association of American Geographers, 52(1962), p+ 462.

institutional factors of member of agricultural societies per million of agricultural families.

Mitra⁹ (1967) was specific in relation of agricultural indicators of regional development, He selected intensity of cultivation expressed as percentage of double cropped area, agricultural inputs i.e., percentage of gross irrigated area, area under cash crops signifying commercialization of agriculture and yield of clean rice indicating efficiency of agricultural practices.

Nath¹⁰ (1969) prepared a composite index of agricultural development based on three factors - the rate of agricultural output, the use of modern inputs and crop-yield per hectare. He also made an attempt to identify the spatial pattern of agricultural development in India by comparing inter-state differences in the levels of agricultural development.

Bhatia¹¹ (1967) and Tiwari¹² (1970) have discussed at length the efficiency of agriculture and relationship of

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9. Mitra, A (1967), Levels of Regional Development in India, Indian Statistical Institute, New Delhi, pp.8-9.
 10. Nath, V. (1969), "The Growth of Indian Agriculture: A Regional Analysis", Geographical Review, 59, p.369.
 11. Bhatia, S.S. (1967), "A New Measure of Agricultural Efficiency in Uttar Pradesh, India", Economic Geography, vol.43, pp.244-60.
 12. Tiwari, R.N. (1970), "Agricultural Development and Population Growth: Analysis of Regional Trends in U.P.", Economic Geography, vol.43.

population growth with agricultural development respectively in Uttar Pradesh.

Sharma¹³ (1971) argued that agricultural development should be assessed not only by levels of productivity or trends of agricultural productivity but also with reference to various physical inputs like irrigation, fertilizers, improved seeds and extent of cultivated area.

Singh¹⁴ (1972) has identified low developed areas in Haryana and also suggested a new method of measuring agricultural productivity.

Spare and Deshpande¹⁵ (1960) used the weighted ranking coefficient technique to identify the inter-district variations in agricultural efficiency in Maharashtra.

M.Shafi¹⁶ (1960) used the technique of ranking coefficients for determining the agricultural efficiency of Uttar Pradesh taking the yield of eight foodgrain crops into consideration.

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13. Sharma, P.S. (1971), "Agricultural Regionalisation of India" in A.Chandra Shekhar (ed.), Economic and Social-Cultural Dimension of Regionalization, New Delhi, pp.253-78.
 14. Singh, J. (1972), "A New Technique for Measuring Agricultural Efficiency in Haryana," The Geographer, vol.19, pp.14-33.
 15. Spare, S.G. and Deshpande, V.D. (1960), "Inter-district Variations in Agricultural Efficiency in Maharashtra," Indian Journal of Agricultural Economics, vol.19, pp.242-52.
 16. Shafi, M.(1960), "Measurement of Agricultural Efficiency in Uttar Pradesh", Economic Geography, vol.36, p.304.

Noor Mohammad¹⁷ has made an attempt to examine the spatial pattern of determinants of agricultural productivity in Bihar.

Bhalla and Alagh¹⁸ (1979) have examined in detail the performance of Indian agriculture during pre-Green Revolution and post-Green Revolution. They also have explained proportional contribution of yield per hectare and area to the growth of agricultural output.

Subaiah and Ahmad¹⁹ (1980) have inferred in their study that physical base exerts impact on agricultural productivity and as much as three-fourths of the variations is explained by physical factors.

Mitra²⁰ (1968) carried out his study on the growth of agricultural output between 1950-51 and 1967-68 and remarked that growth of agriculture declined after second Five Year Plan (1956-61).

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17. Noor, M. and Thakur, R. (1980), "Spatial Variations and Determinants of Agricultural Productivity in Bihar," in Noor Mohammad's, Perspectives in Agricultural Geography, vol.4, pp.317-48.
 18. Bhalla, G.S. and Alagh, Y.K. (1979), Performance of Indian Agriculture - A Districtwise Study, New Delhi, Sterling Publishers Pvt.Ltd., 1979.
 19. Subaiah S. and Ahmad, A (1980), "Determinants of Agricultural Productivity in Tamil Nadu, India", Transaction of Institute of Indian Geographer, no.1, vol.2, pp.15-32.
 20. Mitra, A (1968), "Bumper Harvest has Created Some Dangerous Illusions", The Statesman, 14-15 October 1968.

Rudra²¹ (1970), however, using the same set of data found that growth of agricultural output reflected slight tendency to slow down. The same problem of growth has also been dealt by Vaidyanathan²² (1977), by using data from 1950-51 to 1975-76. He also observed that growth of agriculture as a whole had shown a slight tendency to decelerate albeit the growth rate foodgrains remained constant.

Chaudhury²³ (1981) has computed growth from 1949-50 to 1975-76, being supported Rudra's stand he advocated for further analysis of growth trends in other economic variables that related to agricultural production through backward and forward linkages.

Pal²⁴ (1985) carried out an important study concerned with the empirical measurement of the contribution of irrigation to agricultural productivity, cropping pattern, expansion of cropped area and aggregate production. For this purpose, an economic model has been built in the study.

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21. Rudra, A (1970), The Rate of Growth of Indian Economy: Economic Development in South Asia, Kandy Conference Proceedings edited by E.A.G. Robinson and M. Kidron published by Macmillan, London.
 22. Vaidyanathan, A. (1977), "Constraints on Growth and Policy Options - Reply", Economic and Political Weekly, special number, December 17, 1977.
 23. Chaudhury, M. (1981), "Is the Rate of Growth of Indian Agriculture Diminishing", Economic and Political Weekly, vol.16, no.5, January 31, 1981, pp.155-58.
 24. Pal, S.P. (1985), "Contribution of Irrigation to Agricultural Production and Productivity", National Council of Applied Economic Research.

Desai, Rudolf and Rudra²⁵ (1984) have edited an important study on agrarian power and agricultural productivity. Here they discarded the widely accepted generalization that structures of local power is a major constraint on technically progressive agriculture and argued that there is no necessary relationship between asymmetrical power structures and high and low productivity.

M.Shafi²⁶ (1984) carried out an authentic work on agricultural productivity and regional imbalances in Uttar Pradesh and suggested that the diffusion of skill and technology in the less developed areas should bring about greater improvement in agricultural productivity.

1.7 Personality of the Study Area

1.7.1 Location: The map (Fig.1.1) aims at presenting the geographical location of Uttar Pradesh. The state of Uttar Pradesh, geographically lies between 23° 52' and 31° 28' North latitude, and 77° 04' and 84° 38' East longitude. It contains 1,10,862,813 population and 2,94,411 sq.km. area which covers about 16 per cent of population and about 9 per

25. Desai, M., Rudolf, S.H. and Rudra, A.(1984) (eds), Agrarian Power and Agricultural Productivity in South Asia, Delhi, Oxford University Press.

26. Shafi, M. (1984), "Agricultural Productivity and Regional Imbalances", New Delhi, Concept Publishing Company, pp.148-239.

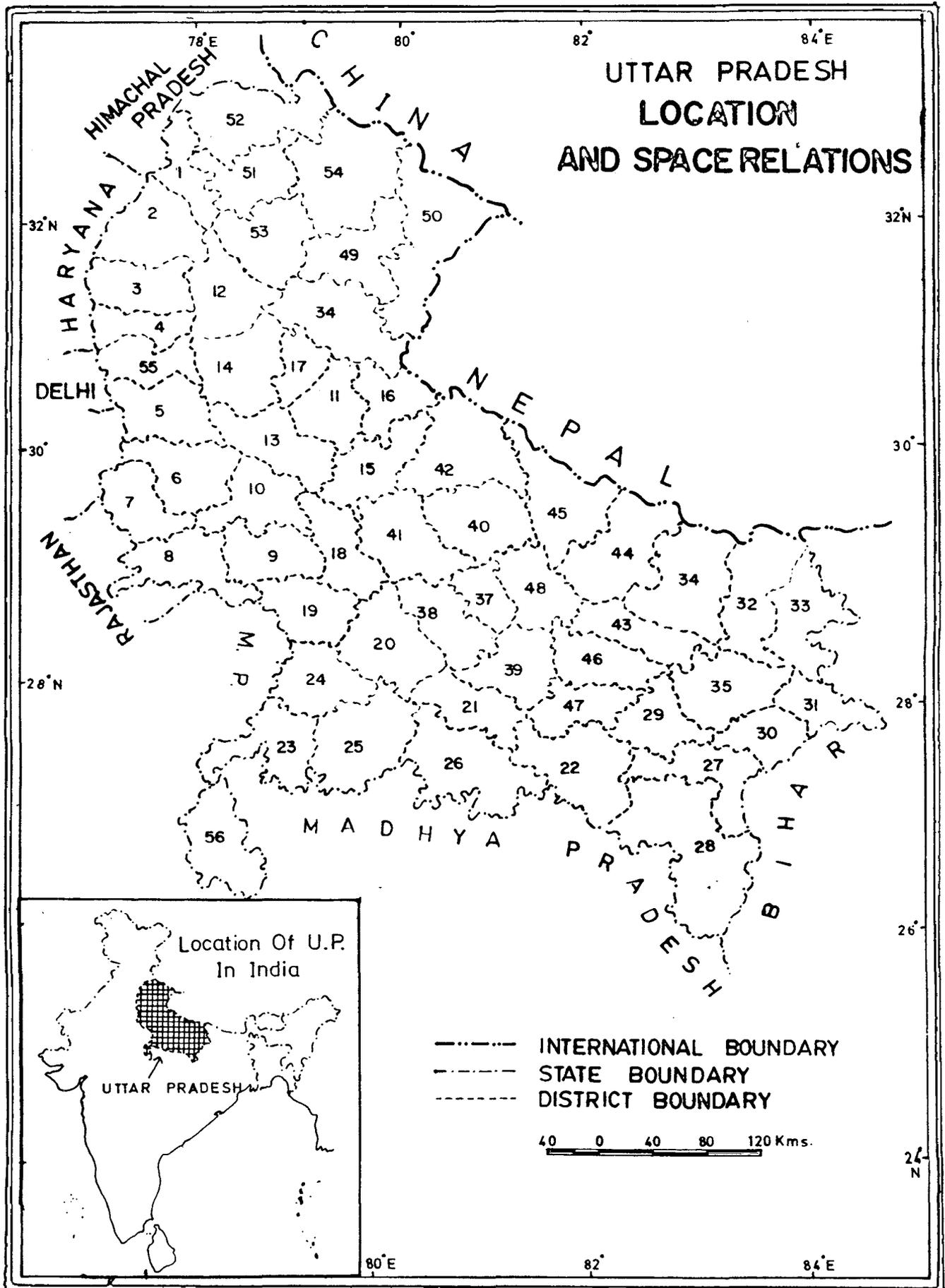


FIG. 11

LIST OF DISTRICTS OF UTTAR PRADESH WITH CODE NUMBERS

S.No.	District	Code	S.No.	District	Code
1.	Agra	8	29.	Hardoi	41
2.	Allahabad	22	30.	Jalaun	24
3.	Aligarh	6	31.	Jaunpur	29
4.	Almora	49	32.	Jhansi	23
5.	Azangarh	35	33.	Kanpur	20
6.	Bahraich	45	34.	Kheri	42
7.	Ballia	31	35.	Lalitpur	56
8.	Banda	26	36.	Lucknow	37
9.	Barabanki	48	37.	Mainpuri	9
10.	Bareilly	11	38.	Mathura	7
11.	Bijnor	12	39.	Meerut	4
12.	Basti	34	40.	Mirzapur	28
13.	Budaun	13	41.	Moradabad	14
14.	Bulandshahr	5	42.	Muzaffarnagar	3
15.	Chamoli	54	43.	Nainital	36
16.	Dehra Dun	1	44.	Pilibhit	16
17.	Deoria	33	45.	Pithoragarh	50
18.	Etah	10	46.	Pratapgarh	47
19.	Etawa	19	47.	Rae Bareli	39
20.	Faizabad	43	48.	Rampur	17
21.	Farrukhabad	18	49.	Saharanpur	2
22.	Fatehpur	21	50.	Shahjahanpur	15
23.	Garhwal	53	51.	Sitapur	40
24.	Ghaziabad	55	52.	Sultanpur	46
25.	Ghazipur	30	53.	Tehri Garhwal	51
26.	Gonda	44	54.	Unnao	38
27.	Gorakhpur	32	55.	Uttar Kashi	52
28.	Hamirpur	25	56.	Varanasi	27

The code numbers of districts are as per the sequence given in the original source, i.e., Season and Crop Reports, Govt. of Uttar Pradesh.

cent of area of the country.²⁷

Uttar Pradesh has well marked boundaries and is bounded by Tibet and Nepal in the north, Himachal Pradesh in the North West, Haryana and Delhi in the West, Rajasthan in the South West, Madhya Pradesh in the South and South West and Bihar in the East.

For administrative purpose the state of Uttar Pradesh was divided into forty-eight districts in 1961, fifty-four districts in 1971 and fifty-seven districts in 1981. But for the study, as it pertains to the district level, forty-eight districts were taken into account in first two period (1961 and 1971) and fifty-six districts in the third period (1981). The names of the districts with their codes are given in the list (1.1) along with location map (fig.1.1) of the state.

1.7.2 Physiography: Structurally the state can be divided into three district regions, namely the Himalayan region, the Ganga plain and the Southern Hill and plateau region.²⁸

(1) The Himalayan Region: The Himalayan region is the northern most region of the state which comprises eight districts of Uttar Kashi, Chamoli, Tehri Garhwal, Garhwal, Pithoragarh,

27. Census of India 1981, Uttar Pradesh, Part II, General Population Table Series.

28. Census of India 1961, Uttar Pradesh, General Report on Census, vol.15, part 1-A(1), p.54.

Almorah, Nainital and Dehradun. This region rises from a height of 300 meters to a magnificent series of snow clad peaks more than 6000 meters above sea level. The region is marked with gradual changes in physical features of climate and vegetation as one moves from the plain towards the hills and it can be divided further into three major sub-divisions.

The greater Himalayas: it is a zone about 50 km. wide with a mean relief between 4,800 meters and 6000 meters. Some of the famous peaks of the Himalayas such as Nanda Devi (7817 meters), Kamet (7756 meters), Badrinath (7138 meters) and Trisul (7120 meters) are located in this region.

The two great historic rivers of India, the Ganga and the Yamuna, rise in this region from glaciers of Gangotri (5611 meters) and Jamunotri (6315 meters) respectively.

The Lesser Himalayas: this zone lies to south of the greater Himalayas and have a number of longitudinal valleys among which the most famous is the Doon valley having a width of 24 to 32 km. This zone of moderate height and very sparse population has a number of beautiful hill-stations such as Mussoorie, Chakrata, Nainital, Ranikhet, Almora etc. Due to the ruggedness of the terrain cultivation is possible only in the river valleys and on the terraced hill slopes. Chief crops of the region are rice, wheat and mandua but recently orchard raising also became quite important.

The Siwaliks: this sub-Himalayan zone runs from north west to south east and passes through the northern part of Saharanpur district, the southern parts of districts Dehra Dun and Garhwal and middle part of Nainital. The zone ranges from 300 to 600 meters in height and is composed of simple type of foldings and faultings.

(ii) The Ganga Plain: This physiographic division of the state extends from northwest to southeast between Himalayas in the north and the hills and plateau in the south. This zone of largely a homogeneous alluvial plain, one of the largest in the world. It accounts for more than half of the state's area. The Gangetic plain has mainly two distinct sub-divisions - Bhabhar and Tarai. The northern part of the plain, which borders the Himalayas and extends from Saharanpur to Deoria districts is known as Bhabhar and has distinct features of its own. It is the piedmont zone skirting the Siwaliks and mainly found in the districts of Saharanpur, Bijnor, Garhwal, Nainital, Pilibhit and Gorakhpur. In this area the rivers flatten and deposit the coarser boulders suddenly, and gravels brought by them from their upper reaches. The Tarai is a marshy tract covered with forest and tall grasses. But it has been diminished by the steady process of settlement and reclamation. The true terai is now confined to narrow strip parallel to the Bhabhar which falls

in the districts of Saharanpur, Bijnor, Nainital, Rampur, Basti, Gorakhpur and Deoria. The Bhabhar and Tarai belts are important for the cultivation of rice, wheat, and sugarcane.

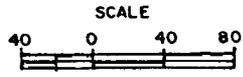
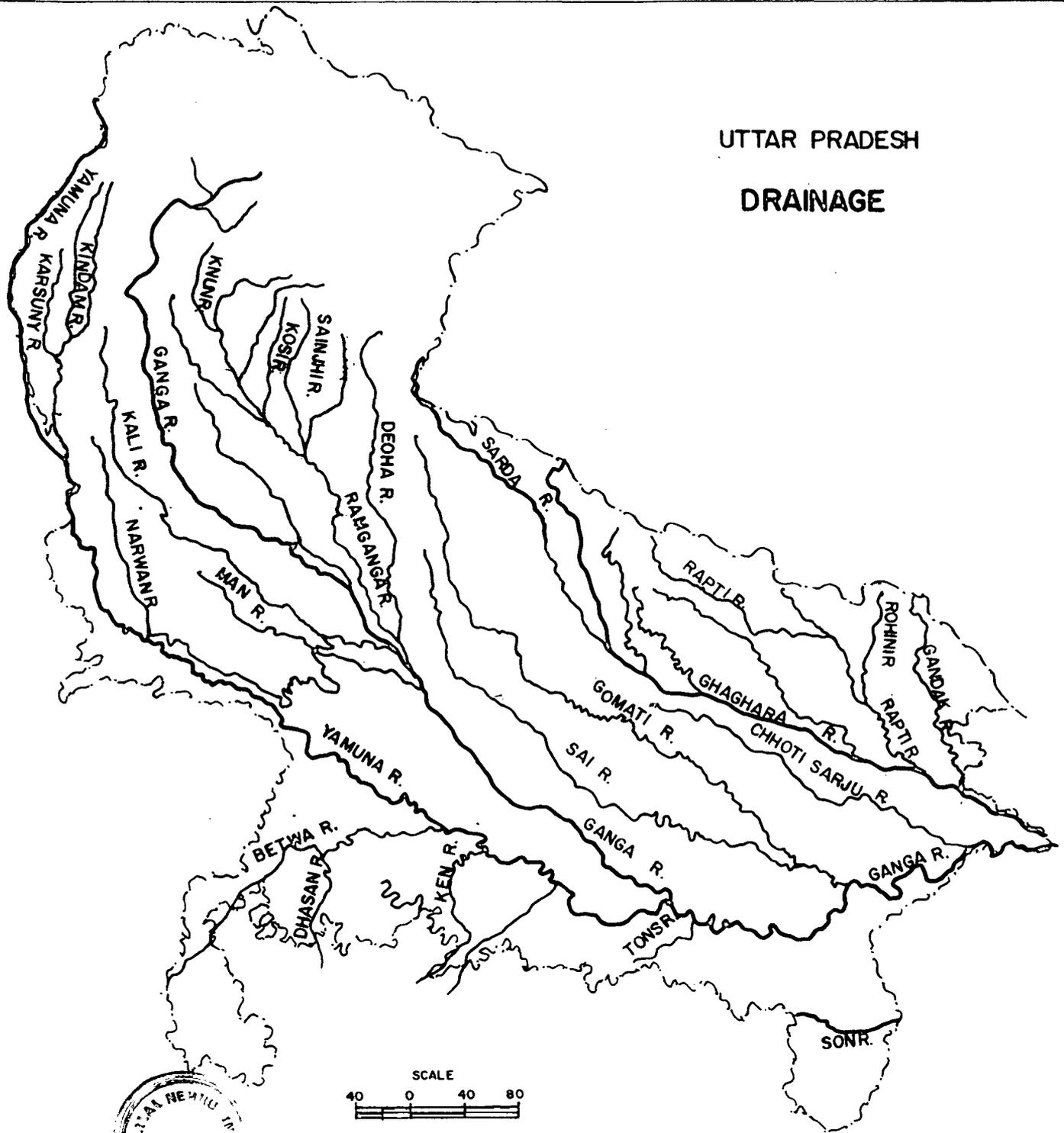
(iii) The Southern Hill and Plateau Region: This region lies in the southern most part of the state and is the oldest and the most stable landmass. It has the rocks of diversified origins. The eastern part of the plateau region belongs to the Vindhyan System whereas the western part comprises of rocky highland plateau. The region covers almost whole of Jhansi, Lalitpur, Jalaun, Hamirpur, Banda and parts of Mirzapur districts. This region lies at a height of about 300 meter and the land is not very suitable for agriculture due to the configuration of land. The whole region either suffers from deficiency of rainfall, and agriculturally it is poor, and a relatively backward region of the state.

1.7.3 Drainage: The drainage system of Uttar Pradesh comprises of a number of rivers and their tributaries. The Ganga is the chief river of the state and rest are its tributaries. The Yamuna is the biggest tributary of the Ganga and flows from west to east followed by other tributaries like Ram Ganga Sai, Gomati and Rapti. Most of these perennial rivers originate from the Himalayas whereas Gomati rises from the Tarai region in the district of Pilibhit.

UTTAR PRADESH

DRAINAGE

9998-11



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338.1609542
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TH2666

SOURCE-- CENSUS ATLAS OF UTTAR PRADESH, 1971.

FIG. 12

The other group of tributaries is of those which emerge from the peninsula and join Yamuna. These rivers are Chambal, Betwa and Ken. The flow of the Himalayan rivers is from northeast to southwest in the upper mountainous region but after reaching the plains, they first flow from north to south. Thereafter change their courses from northwest to southeast. The general slope of the land in the state is from west-northwest to east-southeast (fig.1.2).

1.7.4 Climate: The state of Uttar Pradesh falls mainly into tropical monsoon type of climate with the exception of Himalayan region, where the climate is temperate. The seasonal variation in temperature are substantially large. During winter in the month of January the minimum temperature at some places drops down to about 3°C whenever during summer in the months of May and June, the maximum temperature rises to about $44-45^{\circ}\text{C}$. The climate of the state is characterised by a rhythm of seasons which is caused by the southwest and northeast monsoon. The total reversal of the pressure takes place regularly twice in the course of year. At the time of northeast monsoon winds are of continental origin and blow generally from west to east, while during the southwest monsoon they are oceanic in origin and blow mostly from east to west. The southwest monsoon usually enters the state by the end of June and the state gets most of its

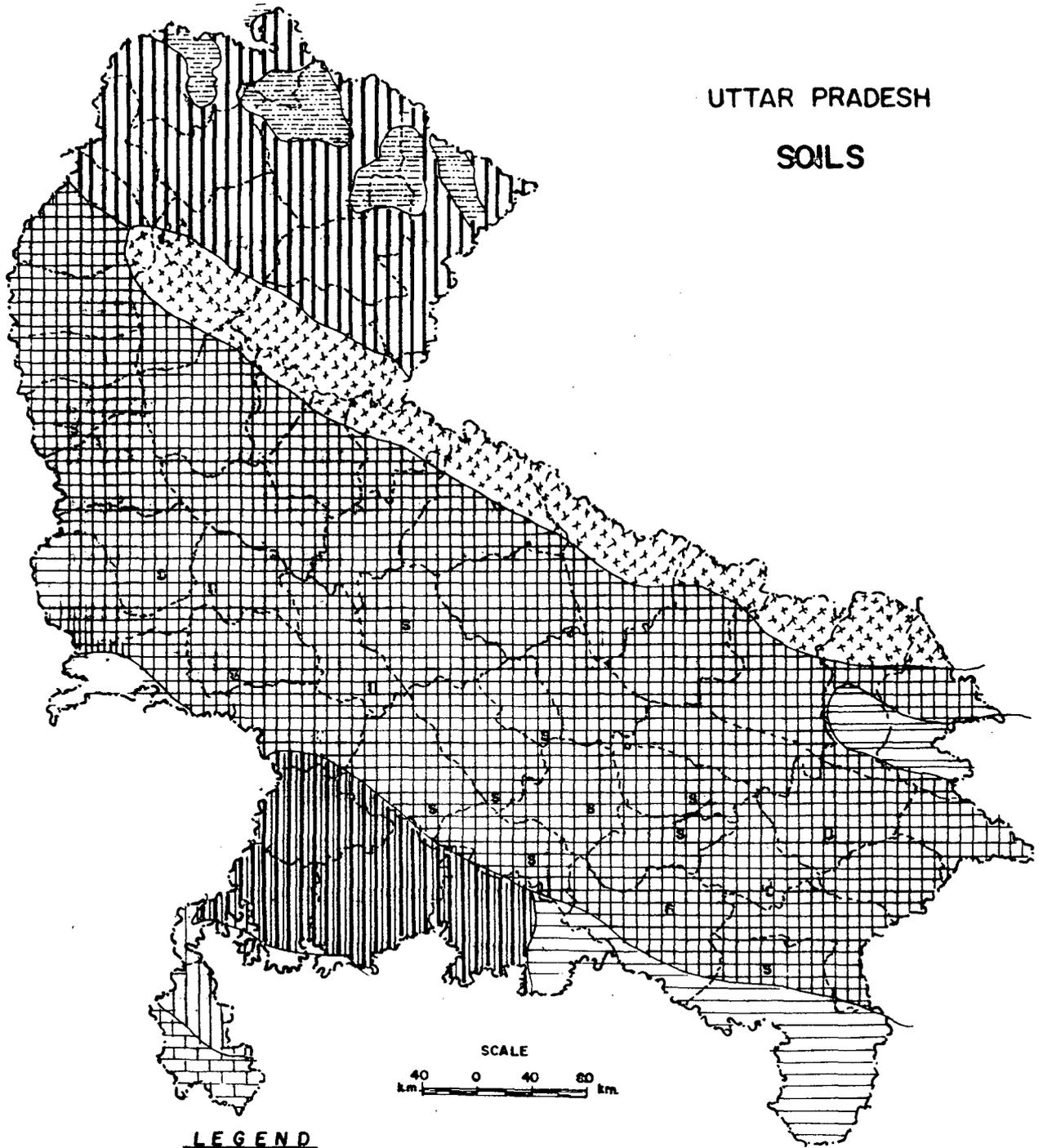
rainfall from it, while the western depressions bring few showers during the winter months. Thus, taking into consideration the temperature and the precipitation, the whole year is divided into three distinct seasons of winter, summer and monsoon rains.

The winter season usually begins from late October and lasts up to the end of February. After a brief transitional period of disturbed weather during March the dry climate sets in at the end of March and the summer season prevails from April to the middle of June or the last week of that month. The rainy season begins from the third or fourth week of June and lasts up to the middle of September.

1.7.5 Soils: The soils of the state broadly follow the pattern of the physiography and vary from one physiographic division to another (Fig.1.3). In the Himalayan region real loam, brown forest soil, podzol and meadow soils are found in the northern part of the region. Whereas in the southern part of the region pebbly and porous soils are found which vary from clayey loam to sandy loam are rich in organic matter.

The soils of Gangetic plains are mostly of the alluvial type which consist of older alluvial (Bangar) and newer alluvium (khader). The Bangar is composed of thick clay beds which have developed calcarious nodules (kankar) and forms higher ground. It is dark in colour, whereas the

UTTAR PRADESH SOILS



LEGEND

	RED SANDY SOILS		TARAI SOILS
	RED AND YELLOW SOILS		BROWN HILL SOILS
	MEDIUM BLACK SOILS		GLACIERS AND ETERNAL SOILS
	MIXED RED AND BLACK SOILS		CALCAREOUS ALLUVIAL SOILS
	ALLUVIAL SOILS-RECENT		SALINE AND ALKALI SOILS

SOURCE - CENSUS ATLAS OF UTTAR PRADESH, 1971

FIG. 13

latter is mainly composed of fine silt and forms the flood plains which are adjacent to the rivers. The central part of the plain is covered with loam or sandy loam soils. Some patches of usar or reh soils are found scattered widely throughout the Ganga plain. These soils are alkaline in character but are good for agriculture.

In plateau region the soils are generally of three types, namely upland or rocky soils, lowland or black soils (mar, kabar), and red and yellow soils (parua, rankar). The upland soils are calcareous and possess a high degree of fertility. The western part of the plateau region is mainly composed of red and yellow soils locally known as parua and rankar soils.

Chapter II

TRENDS IN THE YIELD LEVELS OF MAJOR CROPS

Land as a resource is inextensible and as most of the land is already under cultivation, the scope for physical expansion of cultivable land in the state is quite limited except for marginal increases through the improvement of degraded soil or the provision of drainage in water-logged areas. The only way out to increase the production in the state is through the intensive use of land. The intensive use of land is possible through the adoption of improved farm technology. Here the main thrust is to increase yield per hectare.¹

In the 'post-Green Revolution' era the production of cereals has increased substantially but the pressure of population on land persists. The reasons are mainly rapid increase in population and uneven distribution of agricultural technology throughout the state. The uneven use of the new technology in agriculture consisting of high yielding varieties of seeds, fertilizers, irrigation, pesticides and farm machinery has accentuated variations in production and yield of crops. The variations in agricultural production and crop-yield are due to several other factors also such as

1. Som Nath Pandit (1983), Critical Study of Agricultural Productivity in Uttar Pradesh - 1951-1975, Concept Publishing Company, New Delhi, p.38.

regional differences in size of holdings, tenure systems, management factors, sociological factors, variation in the existence of infrastructure like electricity, transport and lastly, differences in natural resources like water which is considered to be a crucial factor.²

The present chapter is an attempt to analyse the existing spatial variations in yield levels of some important crops in the state. Five major crops, i.e. rice, wheat, barley, maize and sugarcane, have been selected for analysis on the basis of their strength in the gross cropped area in the state.

Wheat

Wheat is one of the most significant cereal crops in Uttar Pradesh. It accounts for about 32 per cent of the total cropped area in the state and 28 per cent share in total production. It also accounts for about 35 per cent of the total cropped area in India as well as 31 per cent of the total production of wheat of the country. The yield of wheat in Uttar Pradesh is 1253 kgs. per hectare which is below the national average of 1322 kgs. per hectare.

The pattern of levels and trends of yield of wheat in Uttar Pradesh can be observed from the following spatio-temporal analysis.

2. Ali Mohd. (1978), Situation of Agriculture, Food and Nutrition in Rural India, Concept Publishing Company, Delhi, p.44.

1960-63: During this period, the yield levels of wheat were low as only two districts - Bulandshahr and Agra - were in the medium category of yield (Table 2.1). Rest 46 districts were either in low or very low categories. The maximum concentration of districts (32 out of 48 districts) was in the low category with yield values of 800 to 1200 kgs per hectare while 14 districts belonged to the very low-yield category. Very high yields of 1320 kgs and 1250 kgs per hectare were recorded in the districts of Bulandshahr and Agra respectively while the districts of Bahraich and Mirzapur recorded very low yields of 550 kgs per hectare and 600 kgs per hectare respectively. Thus, during 1960-63, the low yields were recorded in almost all the districts in the state except two districts of Bulandshahr and Agra. These aforesaid districts have shown moderate levels of yield.

1968-71: There was a definite increase in the yield levels of wheat during this period as all the districts moved up to low and medium categories from very low yield category. During the period the low and medium categories accounted for 46 districts as against the low and very low categories in the earlier period. Due to heavy concentration of districts in two categories no spatial pattern of yield levels emerged in the state during this period. Two contiguous districts of Bulandshahr and Aligarh were in the high category of yield.

Table 2.1

WHEAT YIELD LEVELS (KILOGRAMS PER HECTARE)

Category	1960-63	1968-71	1980-83
Above 2000 (Very High)	-	-	3, 4, 5, 6, 7, 8, 17, 19, 20 and 55 (10 districts)
1600-2000 (High)	-	5 and 6 (two districts)	2, 9, 10, 11, 12, 13, 14, 15, 16, 18, 21, 29, 31, 33, 36, 37, 41, 43, 48. (19 districts)
1200-1600 (Medium)	5 and 8 (two districts)	3, 4, 7, 8, 9, 10, 12, 14, 16, 17, 18, 19, 20, 27, 29, 30, 31, 32, 34, 35, 36, 41 (22 districts)	1, 22, 23, 24, 25, 27, 30, 32, 34, 35, 38, 39, 40, 42, 44, 45, 46, 47, 50 (19 districts)
800-1200 (Low)	1, 3, 4, 6, 7, 9, 10, 12, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29, 30, 31, 32, 33, 35, 36, 37, 38, 39, 43, 46, 47, 48 (32 districts)	1, 2, 11, 13, 15, 21, 22, 23, 24, 25, 26, 28, 33, 37, 38, 39, 40, 42, 43, 44, 45, 46, 47, 48 (24 districts)	26, 28, 49, 51, 52, 53, 54, 56 (8 districts)
Below 800 (Very Low)	2, 11, 13, 14, 15, 16, 27, 28, 34, 40, 41, 42, 44, 45 (14 districts)		

The district-codes correspond to the names listed in Appendix I.

The district of Bulandshahr moved into this category from the medium while the district of Aligarh moved up from the low category. None of the districts was in the very high and the very low categories.

1980-83: In the 'post-Green Revolution' period the position of wheat in terms of yield is much better than pre-Green Revolution period. During this period, 10 districts reached to the very high category of yield while only two districts namely Bulandshahr and Aligarh moved from high to very high category. 8 districts jumped from medium to very high category between 1968-71 to 1980-83. The districts of Muzaffarnagar, Meerut, Ghaziabad, Bulandshahr, Aligarh, Mathura, Agra, Etawa and Kanpur formed a contiguous region of very high yield levels of wheat. The high and medium categories account for equal number of districts during this period, i.e., 19 each. The low yield category comprises of 8 districts namely Lalitpur, Banda, Mirzapur, Almora, Tehri-Garhwal, Garhwal, Uttar Kashi and Chamoli. These districts are either belong to northern hilly tract of Uttar Pradesh or plateau region of Bundelkhand.

Table 2.1 reveals some interesting pattern. It can be observed at a glance that there is an improvement in the yield levels of wheat in the state during the study periods. The major concentration of districts shows a consistent movement from low and very low categories during 1960-63 to medium and low categories during 1968-71 and finally to high and medium

categories during 1980-83. At the same time the number of districts in the high category are increasing with the passage of time. A spatial pattern is also emerging with the passage of time where the western districts of the state can be identified separately forming a region of very high yield level during 1980-83. Similarly, the districts showing poor performance also form some isolated pockets of yield.

Barley: The position of barley in terms of area occupancy was significantly high during 1960s. But due to the inception of high yielding variety in wheat, the area under barley decreased significantly. In 1970s it still occupied about 7 per cent of the total cropped area of the state and about 53 per cent of total cropped area under this crop in India. During eighties also area under the crop continued to decline.

On an average the yield per hectare is also higher (1,040 kgs.) than the national average (1,033 kgs). A significant yield variations can also be noticed from one to another district during all the three periods.

1960-63: During the period, the yield was low mainly because of traditional agricultural practices. Majority of the districts was concentrated in low yield category (700-1000 kgs per hectare). The districts of Dehradun, Mathura, Agra, Farrukhabad, Etawa, Jaunpur, Ghazipur and Sultanpur have recorded moderate yield (700 kgs to 1300 kgs per hectare). None of the districts fell in the high and very high yield categories.

1968-71: During this period, high yield was recorded only in two districts of western Uttar Pradesh, i.e., Aligarh and Mathura. The number of districts in the medium yield category have increased to 11 against 8 districts during the earlier period. The highest concentration of the districts has been recorded in the low category as during 1960-63. The number of districts in the very low yield, category has declined to 7 instead of 14 during the earlier period. None of the districts has entered into very high yield category during 1968-71 (Table 2.2).

1980-83: The yield of barley has considerably increased during 1980-83, and it ranged from 690 kgs per hectare in the district of Gonda to as high as 1,810 kgs per hectare in Aligarh. The districts of Aligarh, Etawa in western and Kanpur in central Uttar Pradesh fell in the category of very high yield. Another set of 10 districts of Western and Central Uttar Pradesh lay under the category of high yield. The major concentration of districts is observed in the category of moderate yield of barley. The very low yield of barley is recorded only in Gonda during 1980-83. The number of districts in the low yield category have declined to 15 during this period as against 28 during 1968-71.

Table 2.2 reveals that there was not much significant change in the levels of yield between 1960-63 and 1968-71 except the yield levels became sharp and yield per hectare

Table 2.2

BARLEY YIELD LEVELS (KILOGRAMS PER HECTARE)

Category	1960-63	1968-71	1980-83
Above 1600 (Very High)	-	-	6, 19, 20. (Three districts)
1300-1600 (High)	-	6, 7. (two districts)	3, 5, 7, 8, 9, 10, 11, 22, 39, 43. (Ten districts)
1000-1300 (Medium)	1, 7, 8, 18, 19, 29, 30, 46. (Eight districts)	8, 9, 10, 18, 19, 20, 30, 31, 34, 35, 46. (Eleven districts)	1, 2, 4, 15, 18, 21, 24, 25, 27, 29, 30, 31, 33, 35, 36, 38, 40, 41, 46, 47, 48, 49, 50, 51, 52, 54, 55. (Twenty-seven districts)
700-1000 (Low)	2, 3, 5, 6, 9, 10, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 31, 33, 35, 37, 38, 39, 41, 43, 47, 48. (Twenty-six districts)	1, 2, 3, 4, 5, 11, 14, 15, 21, 22, 23, 24, 25, 27, 28, 29, 32, 33, 37, 38, 39, 40, 41, 42, 43, 45, 47, 48. (Twenty-eight districts)	12, 13, 14, 16, 17, 23, 26, 28, 32, 34, 37, 42, 45, 53, 56. (Fifteen districts)
Below 700 (Very low)	4, 11, 12, 13, 14, 15, 16, 32, 34, 36, 40, 42, 44, 45. (Fourteen districts)	12, 13, 16, 17, 26, 36, 44. (Seven districts)	44 (One district)

The district-codes correspond to the names listed in Appendix I.

has gone up as high as 1810 kgs. per hectare during 1980-83. The districts which showed a significant change in their yield levels are Allahabad, Faizabad, Rae Bareilly, Bareilly, Etah, Kanpur, Bulandshahr, Muzaffarnagar and Mainpuri. The districts which have showed comparatively high yield levels of barley in all the periods are mainly Mathura, Agra and Etawa.

Rice:

Rice is an important cereal crop and the second most significant food grain crops after wheat in Uttar Pradesh. It occupies about 13 per cent of the total cropped area of India and about 23 per cent of the total cropped area of Uttar Pradesh. The state contributes about 9 per cent of the total rice production of India. But per hectare yield is only 779 kgs. per hectare which is far below the national average of 1,106 kgs per hectare. The yield of rice has improved with time in the state. The levels and trends of yield during three different time periods have been discussed in the following pages.

1960-63: During this period, most of the districts were characterised with low yield levels of rice. All the districts of state except six districts were confined to the low and very low categories of yield. The aforesaid 6 districts were in the medium yield category. These districts were Dehradun and Nainital in northern hilly tract, Saharanpur, Farrukhabad and

Etawa in the West and Kanpur in the central parts of the state. Rest of the 42 districts jointly formed a very big contiguous region of low yields of rice. The contiguous region of low yields included the Bundelkhand region, except district of Banda, which was characterised by low yields of rice and whole of Eastern Uttar Pradesh except districts of Varanasi and Jaunpur.

Majority of the districts of western and Central Uttar Pradesh were under the category of low yield of rice (Appendix IV). Both low and very low categories included 21 districts each. (Table 2.3).

1968-71: During this period only one district, i.e., Nainital could move to high yield category. The districts of Dehradun and Saharanpur did not show any improvement as both were in the medium category of yield. On the other hand, the districts of Etawah and Kanpur have shown decline in rice yield levels. Both moved down from medium category during 1960-63 to low category in 1968-71. Meerut district had shown improvement in the yield levels as it moved from low category to medium category.

The districts of low category which has not shown any change between the first two periods, include Muzaffarnagar, Bulandshahr, Badaun, Shahjahanpur, Pilibhit, Unnao and Barabanki. Ghazipur and Gorakhpur districts had moved from

Table 2.3

RICE YIELD LEVELS (KILOGRAMS PER HECTARE)

Category	1960-63	1968-71	1980-83
Above 1400 (Very high)	-	-	2, 3, 16, 17. (Four districts)
1200-1400 (High)	-	36 (one district)	4, 36, 48, 11, 12, 14, 15, 20, 27, 33, 52. (Eleven districts)
1000-1200 (Medium)	1, 2, 18, 19, 20, 36. (six districts)	1, 2, 4. (three districts)	1, 6, 7, 8, 13, 19, 21, 22, 29, 32, 37, 38, 39, 42, 43, 47, 49, 51, 54, 55. (Twenty districts)
800-1000 (Low)	3, 4, 5, 6, 7, 9, 10, 11, 13, 15, 16, 21, 26, 27, 29, 38, 39, 41, 46, 47, 48. (Twenty one districts)	3, 5, 13, 15, 16, 17, 19, 20, 30, 32, 38, 48. (Twelve districts)	9, 10, 18, 28, 30, 31, 35, 40, 41, 46, 50, 53. (Twelve districts)
Below 800 (Very low)	8, 12, 14, 17, 22, 23, 24, 25, 28, 30, 31, 32, 33, 34, 35, 37, 40, 42, 43, 44, 45. (Twenty-one districts)	6, 7, 8, 9, 10, 11, 12, 14, 18, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 33, 34, 35, 37, 39, 40, 41, 42, 43, 44, 45, 46, 47. (Thirty-two districts)	5, 23, 24, 25, 26, 34, 44, 45, 56. (Nine districts)

The district-codes correspond to the names listed in Appendix I.

very low to low category between 1960-63 to 1968-71. A significant change can be observed in the number of districts in the very low category. The total number of districts in this category had increased from 21 during 1960-63 to 32 in 1968-71. Eleven districts had moved from low to very low category during this period which include Bareilly, Aligarh, Etah, Mainpuri, Hardoi, Fatehpur, Banda, Rae Bareli, Sultanpur, Jaunpur and Varanasi.

The overall pattern during this period had shown a decline in the yield levels. Three districts were in the medium and 12 districts in the low categories as against 6 and 21 districts in these categories during the earlier periods.

1980-83: This period of time, shows a better and balanced distribution of districts in all the categories as compared to earlier two periods of study. It also shows an improvement in rice yields as only 21 districts are concentrated in low and very low categories (Table 2.3). The high category includes four districts namely Saharanpur, Muzaffarnagar, Pilibhit and Rampur. The last three districts have shown a significant shift as they have moved from low to very high category between 1968-71 and 1980-83. Saharanpur district has jumped from medium to very high category during this period. Though there was only one district in the high category during 1968-71, which has 11 districts in 1980-83. Similarly, the number of

districts in the medium category have shown a marked increase from three during 1968-71 to twenty districts in 1980-83. There is no change in the number of districts in the low category of yield. Finally the very low category has shown a significant decline in the number of districts from 32 during 1968-71 to only 9 during this period. Only Bulandshahr district has shown decline in its rank among all the districts of the state. It has moved down from low to very low category between 1968-71 and 1980-83.

No spatial pattern can be identified of the yield levels of rice in the state as only two or three districts form a contiguous region of homogenous yields. The Bundelkhand plateau region is an exception as five out of six districts form a contiguous region of very low yield levels. Temporarily also no pattern can be identified as there are large ups and downs in the number of districts of various categories. Except a few of all the districts have shown a large fluctuation in their yield levels.

Maize: Maize, a coarse grain, is a kharif crop of Uttar Pradesh. It is grown with the first summer rains and is harvested almost as soon as the rains stop. Its cultivation is adversely affected if the rains come late, and the crop is damaged, if there are very long intervals between the rainy periods. Maize occupies about 7.5 per cent of the total cropped area of Uttar Pradesh.

But its share is only 4 per cent in the total production of the state. The share of area and output of maize in Uttar Pradesh to the total area and output of maize in India is about 26 per cent and 21 per cent respectively.

The yield of maize in Uttar Pradesh is 891 kgs. per hectare which is lower than the national average of 1085 kgs per hectare.

1960-63: The maize yield in Uttar Pradesh varies between 1520 kgs per hectare in Fatehpur to 240 kgs per hectare in Mathura during this period. Table 2.4 shows the maximum concentration of districts in the low category followed by the medium category. The very high yield was recorded in the district of Fatehpur. Three districts of Dehradun, Farrukhabad and Hamirpur showed high yield which varied between 1000 and 1300 kgs per hectare. The districts of Mathura, Agra, Budaun, Sitapur and Sultanpur showed very low levels of yield.

1968-71: The district of Jaunpur has shown a significant increase in the yield levels. It moved from medium to very high category between 1960-63 to 1968-71. Farrukhabad district has shown no change in its yield level while Dehradun and Hamirpur districts have moved down from high to medium category. A significant shift can also be observed in low and very low categories as most of the districts of these categories have

Table 2.4

MAIZE YIELD LEVELS (KILOGRAMS PER HECTARE)

Category	1960-63	1968-71	1980-83
Above 1300 (Very high)	21 (one district)	29 (one district)	1, 4, 5, 36, 55. (Five districts)
1000-1300 (High)	1, 18, 25. (Three districts)	4, 5, 6, 10, 18, 21, 22, 23, 24, 26, 36, 39, 41. (Thirteen districts)	6, 50, 51, 52. (Four districts)
700-1000 (Medium)	11, 12, 14, 15, 17, 22, 28, 29, 30, 31, 32, 33, 35, 36, 37, 39. (Sixteen districts)	1, 2, 3, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 27, 28, 30, 31, 32, 33, 34, 25, 19, 20, 35, 37, 38, 43, 45, 46, 47, 48. (Thirty-one districts)	2, 3, 10, 12, 13, 16, 7, 18, 21, 27, 28, 29, 30, 35, 37, 38, 43, 45, 49, 53, 54. (Twenty-one districts)
400-700 (Low)	2, 3, 4, 5, 6, 9, 10, 16, 19, 20, 23, 24, 26, 27, 34, 38, 41, 42, 43, 44, 45, 47, 48. (Twenty-three districts)	42, 44. (Two districts)	7, 8, 9, 11, 14, 15, 19, 20, 22, 23, 24, 25, 26, 31, 33, 34, 39, 41, 42, 44, 56. (Twenty-one districts)
Below 400 (Very low)	7, 8, 13, 40, 46. (Five districts)	40 (one district)	32, 40, 46, 47, 48. (Five districts)

The district-codes correspond to the names listed in Appendix I.

moved up. The number of districts have declined from 28 during 1960-63 to only 3 districts. These three districts are Kheri and Gonda in the low category and Sitapur in very low category.

1980-83: During this period, an increase is noticed in a number of districts in the very high yield (more than 1300 kgs per hectare), while the number of districts in the high yield level (1000-1300 kgs per hectare) has declined to four as against thirteen in the earlier period. A decline in the number of districts can also be seen in the medium category from 31 to 21. At the same time the low category has witnessed a marked increase (from 2 to 21) in the number of districts between 1968-71 and 1980-83.

The very high category includes the districts of Dehra Dun, Meerut, Bulandshahr, Nainital and Ghaziabad while the high category includes Aligarh, Uttar Kashi, Tehri Garhwal and Pithoragarh districts. The districts, Gorakhpur, Sitapur, Sultanpur, Pratapgarh and Barabanki are in the very low category of yield. The medium and low categories account for 21 districts each.

The yield levels show no definite pattern as there are large fluctuations in the number of districts of all the five categories. The districts which have shown no change in all the three study periods in their yield levels include Bijnor,

Rampur, Mirzapur, Ghazipur, Azamgarh and Lucknow in the medium category, Kheri and Gonda districts in low category and Sitapur in the very low category.

Sugarcane: In Uttar Pradesh sugarcane is a very important commercial crop, because of its money yield. It is grown in almost all the districts of Uttar Pradesh. But the yield per hectare is low as compared to national average of 57,844 kgs. per hectare during 1980-81. But there are significant variations in yields. The highest yield (50,530 kgs per hectare) is recorded in Dehra Dun district while the lowest (31,770 kgs per hectare) in Jhansi district during 1980-83.

1960-63: The distribution of districts in various yield levels show a kind of uniform distribution. No category shows a marked concentration of districts. Fourteen districts were concentrated in the low category followed by 13 in high, 10 in the very low, 9 in medium and 2 in the very high category of yield. The districts of Muzaffarnagar and Nainital have shown very high yields. The two categories of low yield comprised 50 per cent districts of the state during this period (Table 2.5).

1968-71: During this period the very high and medium categories have shown a significant increase in the number of districts while on the other hand, the other three categories have shown decline in the number of districts. The district of Nainital which was in the very high category during 1960-63 has moved down to

Table 2.5

SUGARCANE YIELD LEVELS (KILOGRAMS PER HECTARE)

Category	1960-63	1968-71	1980-83
Above 45,000 (Very high)	3, 36 (Two districts)	1, 2, 3, 4, 14, 28, 30, 31, 32, 34. (Ten districts)	1, 2, 3, 4, 5, 12, 14, 15, 32, 36, 38, 39, 55. (Thirteen districts)
40,000-45,000 (High)	2, 4, 11, 12, 14, 19, 21, 22, 29, 32, 34, 35, 43. (Thirteen districts)	8, 9, 11, 12, 17, 27, 33, 36, 37, 44, 48. (Eleven districts)	6, 10, 11, 13, 16, 17, 18, 21, 29, 33, 34, 40, 43, 44, 45. (Fifteen districts)
35,000-40,000 (Medium)	1, 7, 9, 16, 20, 28, 30, 31, 33. (Nine districts)	5, 10, 13, 15, 16, 29, 35, 38, 39, 40, 41, 42, 43, 45, 46, 47. (Sixteen districts)	8, 9, 19, 20, 22, 27, 31, 35, 37, 41, 42, 46, 47, 48. (Fourteen districts)
30,000-35,000 (Low)	5, 15, 17, 18, 26, 27, 37, 40, 41, 42, 44, 46, 47, 48. (Fourteen districts)	6, 7, 18, 19, 20, 21, 22. (Seven districts)	7, 23, 24, 25, 26, 28, 30, 56 (Eight districts)
Below 30,000	6, 8, 10, 13, 23, 24, 25, 38, 39, 45. (Ten districts)	23, 24, 25, 26. (Four districts)	50, 53 (Two districts)

Data not available for four districts (49, 51, 52, 54).

The district-codes correspond to the names listed in Appendix I.

medium category in 1968-71. The district of Saharanpur, Meerut, Moradabad, Gorakhpur and Basti have moved from high to very high category. The other districts which jumped from medium to very high category include Dehradun, Mirzapur, Ghazipur and Ballia. The Muzaffarnagar district has remained in the very high category. The districts which have shown improvement in their yield levels include Bulandshahr, Shahjahanpur, Sitapur, Hardoi, Kheri, Sultanpur and Partapgarh from low to medium category and district of Aligarh from very low to low category.

The districts which have shown downward movement include Jaunpur, Azamgarh and Faizabad from high to medium category, Mathura and Kanpur district from medium to low category and Banda district from low to very low category.

1980-83: Half of the districts of Uttar Pradesh lay in high and very high yield levels. It shows an improvement in the yield levels over the earlier two study periods. The categories which have shown an increase in the number of districts include very high, high and low, while in medium and low categories the number of districts decreased. Only two districts namely Pithoragarh and Garhwal show very low yield levels. All the districts of Bundelkhand region along with the districts of Mathura and Ghazipur show low level of yield. Except four districts, the rest 15 districts of western Uttar Pradesh lie in the high and very high categories of yield. The four districts

namely Agra, Mainpuri, Etawah and Kheri are in the medium yield category.

The overall distribution pattern of the districts show two marked trends. Firstly, the number of districts in the very high category are increasing continuously. There were only two districts in this category during 1960-63 which increased to 10 during 1970-71 and to 13 during 1980-83. Secondly, the number of districts in the very low category are declining continuously. There were 10, 4, 3 districts in this category in the successive study periods. The other categories show fluctuations in the total number of districts and no pattern can be identified.

Chapter-III

LEVELS OF AGRICULTURAL PRODUCTIVITY AND INPUT USE

The main objective of the present chapter is to examine the variations (regional and temporal) in agricultural productivity and the levels of various technological and environmental inputs in explaining these variations in Uttar Pradesh during 1960-61 to 1982-83. The variables which are chosen for the study are as follows.

A. Technological Factors

1. Consumption of fertilizers in terms of tonnes per thousand hectares.
2. Irrigation in terms of proportion of gross irrigated area to gross cropped area.
3. Mechanisation in terms of WPe per thousand hectares*

B. Other Factors

1. Cropping intensity
2. Irrigation intensity
3. Variability of rainfall.

Pattern of Agricultural Productivity

Productivity in agriculture is defined generally in two ways. In its most accepted form, it is defined as yield of different crops per hectare. This is known as land-productivity.

*Wooden plough equivalent.

It can also be defined as labour productivity, i.e., output per worker employed. Each type of productivity, has its own relative merits and demerits.¹

In the 23rd Annual Conference of Indian Society of Agricultural Economics (1965), it was agreed that "though there are several factors responsible for agricultural productivity in different regions, it would be convenient and operationally meaningful, if comparison is based on productivity per unit of land while variations in respect of other factors might be viewed as possible causes of variations in productivity".²

Thus, output per unit of land is considered to be the standard form of expressing and measuring agricultural productivity. To standardise production units of different crops the output of crops has been obtained in value terms by multiplying it by their respective constant prices. The sum of all the output converted in value terms gives the value of total output in money terms. In the present study, productivity in value terms has been worked out by dividing the total value of output with the net sown area in each districts for all three periods (1960-63, 1968-71 and 1980-83) separately.

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1. Gosal, G.S. and Krishna, G. (1984), Regional Disparities in Levels of Socio-Economic Development in Punjab, Vishal Publications, Kurukshetra, p.52.
 2. V.M.Dandekar, "Summary of Group Discussions on Regional Variations in Agricultural Development", Indian Journal of Agricultural Economics, vol.19 (1964), p.264.

For analysing the spatial pattern of productivity in the state, during all the corresponding periods, the agricultural productivity values have been grouped into five categories (very high, high, medium, low and very low).

1960-63: This was a pre-Green Revolution period and the agricultural practices were traditional in the state. The agricultural productivity during this period was low which varied from Rs.4,669 per hectare in Muzaffarnagar to Rs.1,366 per hectare in Bahraich (Appendix V). When classified and mapped (Fig. 3.1), the districts under the five categories formed the following distribution. (Table 3.1).

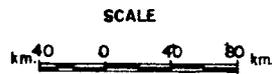
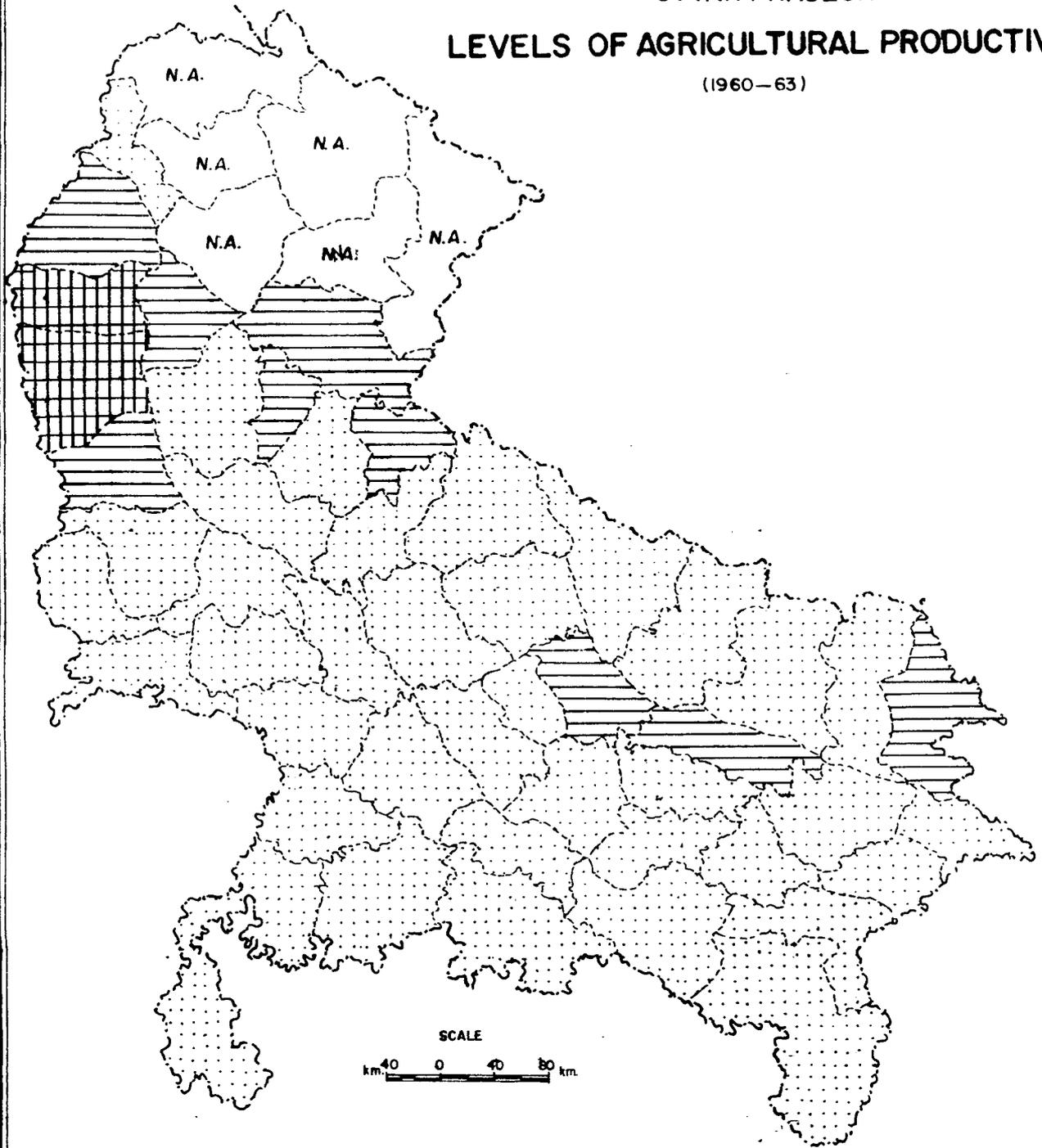
The major concentration of the districts can be observed in the very low category of productivity. Majority of the districts (37 out of 48) in the state, were characterised with very low agricultural productivity. The districts of Muzaffarnagar and Meerut fall in the medium category. Remaining nine districts fell into the low category of productivity during 1960-61 (see Table 3.1).

1968-71: This was early Green Revolution period when new agricultural innovations were introduced and were being adopted and in result agricultural productivity started to increase. Table 3.1 reveals that number of districts have increased in the low and medium categories, because of an upward shift from

UTTAR PRADESH

LEVELS OF AGRICULTURAL PRODUCTIVITY

(1960-63)



AGRICULTURAL PRODUCTIVITY IN RUPEES

V. HIGH		7200 and above
HIGH		5600 - 7200
MEDIUM		4200 5600
LOW		2800 4200
V. LOW		Less than 2800
N. A.		DATA NOT AVAILABLE

FIG. 3-1

Table 3.1

AGRICULTURAL PRODUCTIVITY LEVELS
(Productivity in Rs.)

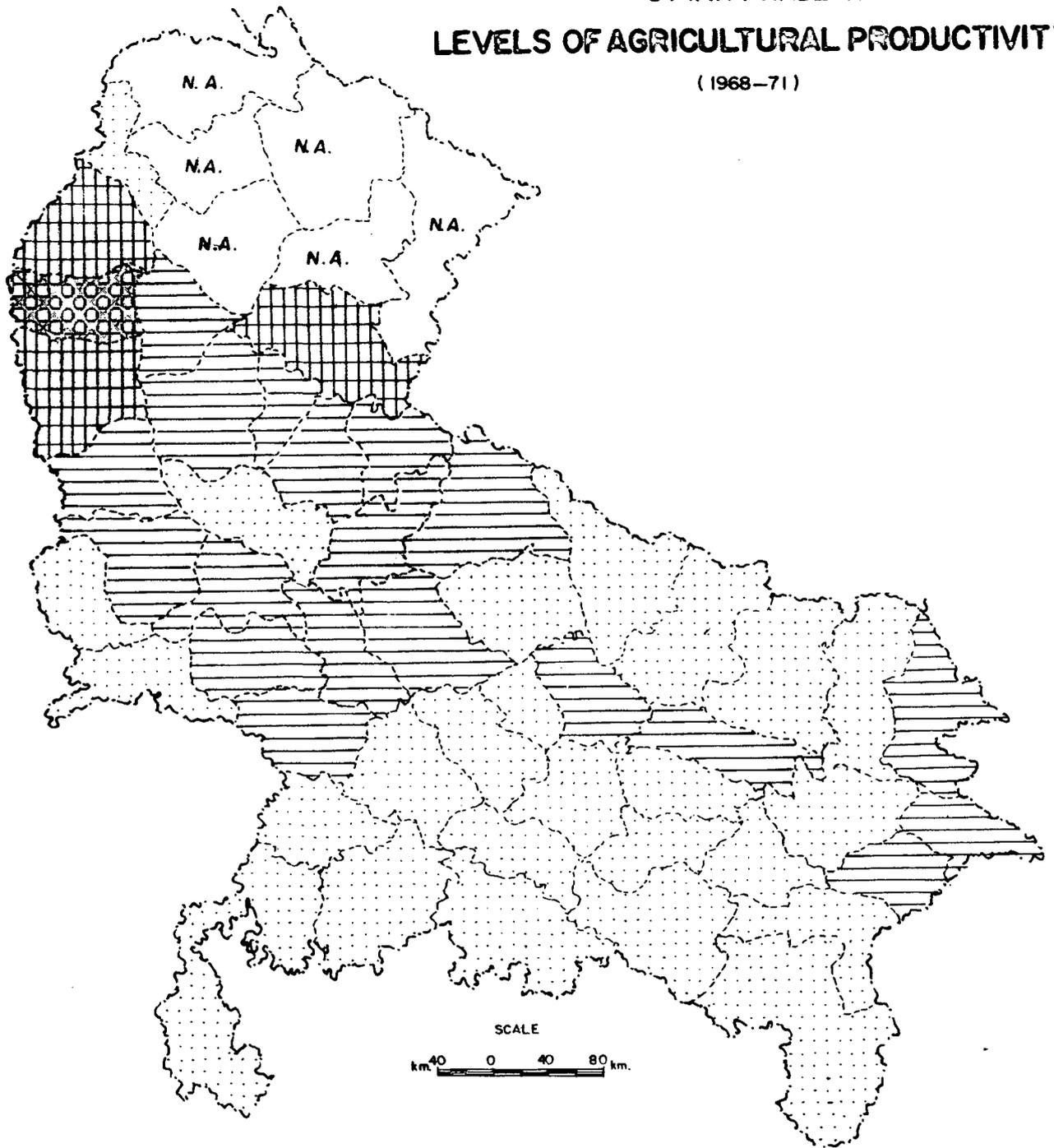
Category	1960-63	1968-71	1980-83
Above 7200 (Very High)	-	-	3, 4. (Two districts)
5600-7200 (High)	-	3 (one district)	2, 5, 12, 16, 36, 55. (Six districts)
4200-5600 (Medium)	3, 4 (Two districts)	2, 4, 36. (Three districts)	33, 43, 11, 14, 17, 18, 19 (Seven districts)
2800-4200 (Low)	2, 5, 12, 16, 17, 33, 36, 43, 48 (Nine districts)	5, 6, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 30, 31, 33, 41, 42, 43, 48. (Nineteen districts)	1, 6, 7, 8, 9, 10, 13, 15, 20, 21, 22, 27, 29, 30, 31, 32, 35, 37, 38, 39, 40, 41, 42, 44, 46, 47, 48, 34. (twenty-eight districts)
Below 2800 (Very low)	1, 6, 7, 8, 9, 10, 11, 13, 14, 15, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 37, 38, 39, 40, 41, 42, 44, 45, 46, 47. (Thirty-seven districts)	1, 7, 8, 13, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 34, 35, 37, 38, 39, 40, 44, 45, 46, 47. (Twenty five districts)	23, 24, 25, 26, 28, 45, 49, 50, 51, 52, 53, 54, 56. (Thirteen districts)

The district-codes correspond to the names listed in Appendix I.

the very low category between 1960-68 and 1968-71. The agricultural productivity during this period varied between Rs.5841 per hectare in Muzaffarnagar and Rs.1540 per hectare in Jhansi (Appendix V). Muzaffarnagar is the only district which is characterised with high productivity level (Fig.3.2). Three districts, viz., Saharanpur, Meerut and Nainital fell in the range from Rs.5600 per hectare to Rs.4200 per hectare. More than 50 per cent districts (25 out of 48) are still concentrated in the very low productivity category. The low productivity category consists of 19 districts of the state (Table 3.1).

1980-83: This is a period of marked increase in agricultural productivity in the state. The agricultural productivity variations among districts during this period are more than that of the previous periods. It varies from Rs.8619 per hectare in Muzaffarnagar to Rs.1428 per hectare in Garhwal (Appendix V). The distribution of district among the categories is more uniform in this period than the earlier periods (Table 3.1). The very high and high categories have 2 and 6 districts respectively where productivity exceeds Rs.5,600 per hectare. The medium productivity category comprises only 7 districts, while in the low and very low categories, there are 28 and 13 districts respectively. The districts of high and very high productivity form a contiguous region in Western Uttar Pradesh (Fig. 3.3).

UTTAR PRADESH
LEVELS OF AGRICULTURAL PRODUCTIVITY
 (1968-71)

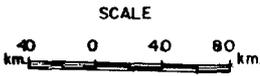
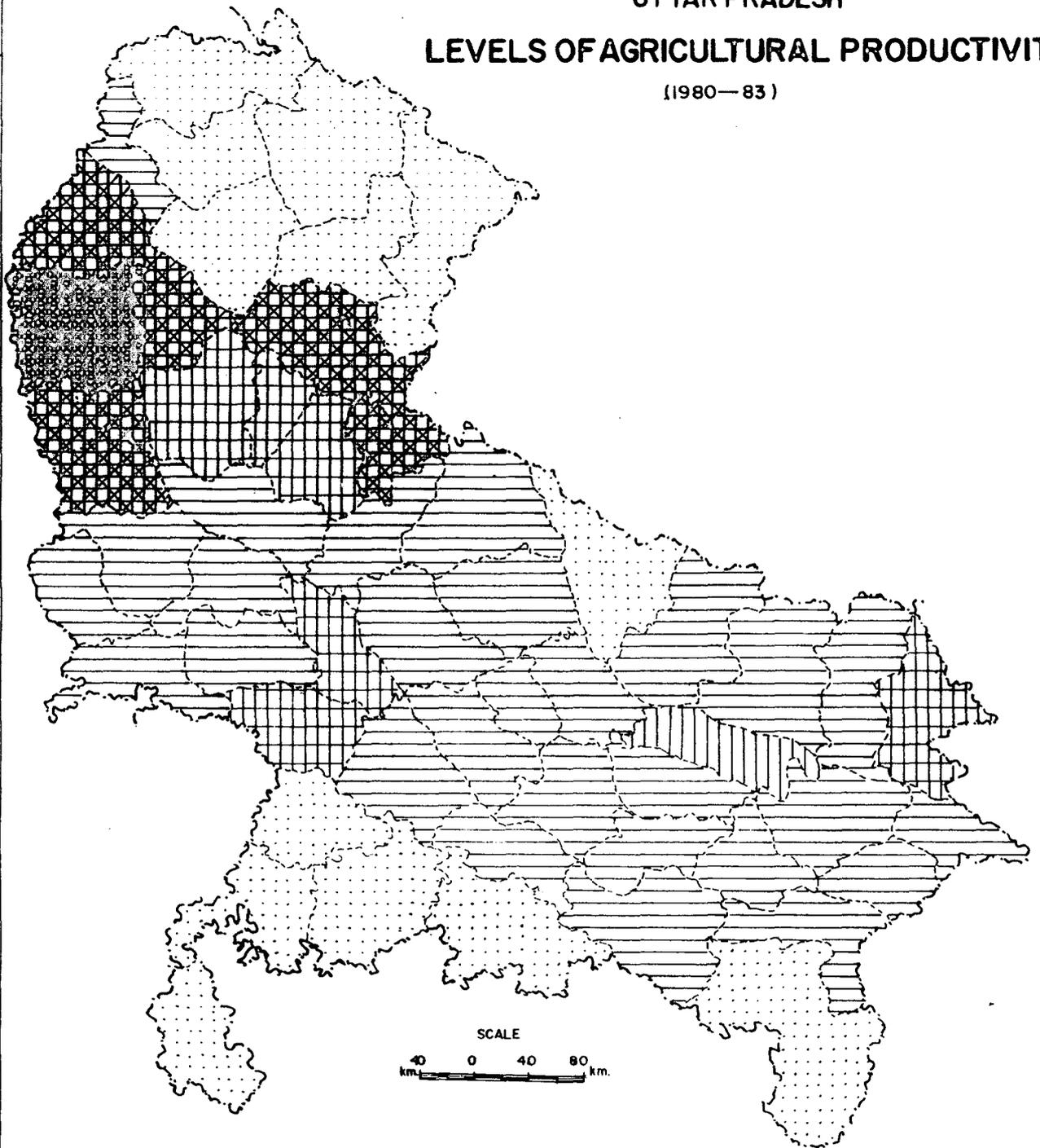


AGRICULTURAL PRODUCTIVITY IN RUPEES

V. HIGH		7200 and above
HIGH		5600 7200
MEDIUM		4200 5600
LOW		2800 4200
V. LOW		Less than 2800
N. A.		DATA NOT AVAILABLE

FIG. 3-2

UTTAR PRADESH
LEVELS OF AGRICULTURAL PRODUCTIVITY
 (1980—83)



AGRICULTURAL PRODUCTIVITY IN RUPEES

V. HIGH		7200 and above
HIGH		5600 7200
MEDIUM		4200 5600
L. LOW		2800 4200
V. LOW		Less than 2800
N. A.		DATA NOT AVAILABLE

FIG. 3-3

The overall pattern of distribution of districts among productivity categories shows that there is an upward shift of the districts during successive periods. The western districts experienced a phenomenal shift between 1960-63 and 1980-83. There were only nine districts in the low category in the first period which increased to 19 in the second and 28 in the third period. The districts of Saharanpur and Nainital moved in medium category from the low category between 1960-63 and 1980-83. The district of Muzaffarnagar shifted to high category from the medium category between the first and second period. During 1980-83, the districts in the medium and high categories increased to seven and six against three and one respectively during 1968-71. The districts of Meerut and Muzaffarnagar have shifted to very high category during 1980-83 from the high and medium categories of productivity during 1968-71 (Figs. 3.2 and 3.3).

Growth Pattern of Agricultural Productivity

The classification of growth rates at three time periods (1960-63, 1968-71 and 1980-83) provides a pattern of productivity trends in the state.

1968-71 Over 1960-63: The districts falling in the high and medium productivity categories, i.e., Muzaffarnagar, Meerut, Saharanpur and Nainital during both periods show low annual growth rates, ranging from 3 per cent to 1.5 per cent. On the other hand, the district of Ghazipur continued to remain in

the low productivity category during both periods but it has shown very high growth rate (6.6 per cent) (Appendix VI).

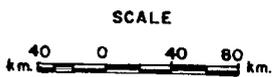
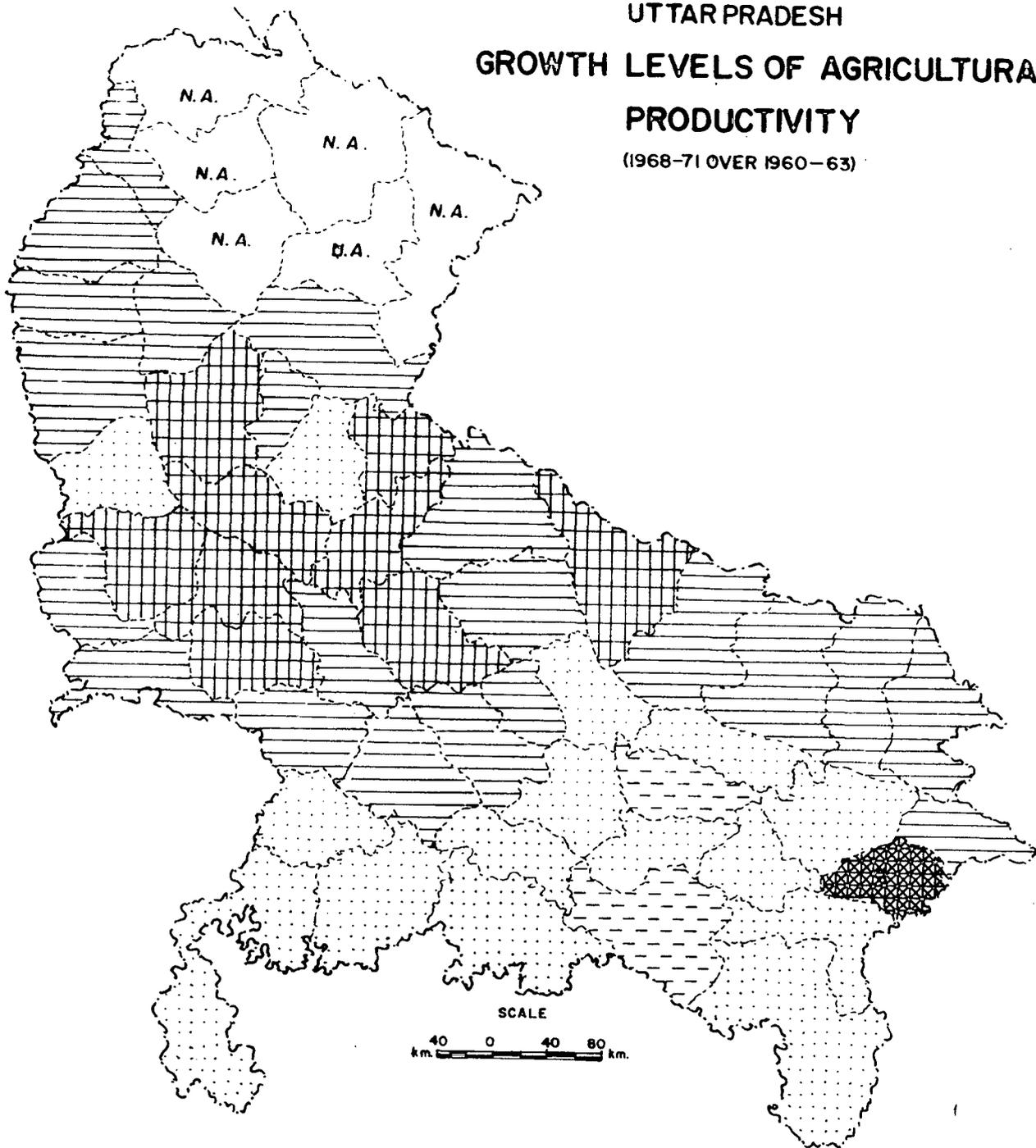
The high productivity districts i.e. Muzaffarnagar, Meerut and Nainital have shown comparatively low growth between 1960-63 and 1980-83 due to their higher base (Fig. 3.4).

1980-83 Over 1968-71: The district of Moradabad as noticed earlier for its low productivity during 1968-71 comes under the category of high growth rate. The district of Ghazipur in eastern Uttar Pradesh is characterised by declining productivity rate (Table 3.2). Majority of the districts are concentrated in the region of low growth rate of productivity ranging between 1.59 and 3 per cent. The districts of Bahraich, Basti and Hardoi have shown a very low growth in agricultural productivity between 1968-71 and 1980-83 (Fig. 3.5).

1980-83 Over 1960-63: Since sixties, the agricultural productivity has shown a positive growth in every district of the state. But majority of the districts experienced low annual growth in agricultural productivity. There are only three districts i.e., Mirzapur, Banda, and Hamirpur which were under the category of very low growth rate. None of the districts has shown negative growth in agricultural productivity during eighties over sixties. The district of Saharanpur, Muzaffarnagar, Meerut, Bijnor, Moradabad, Rampur, Nainital, Pilibhit, Shahjahanpur, Badaun and

UTTAR PRADESH GROWTH LEVELS OF AGRICULTURAL PRODUCTIVITY

(1968-71 OVER 1960-63)



ANNUAL COMPOUND GROWTH RATE IN PERCENT

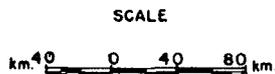
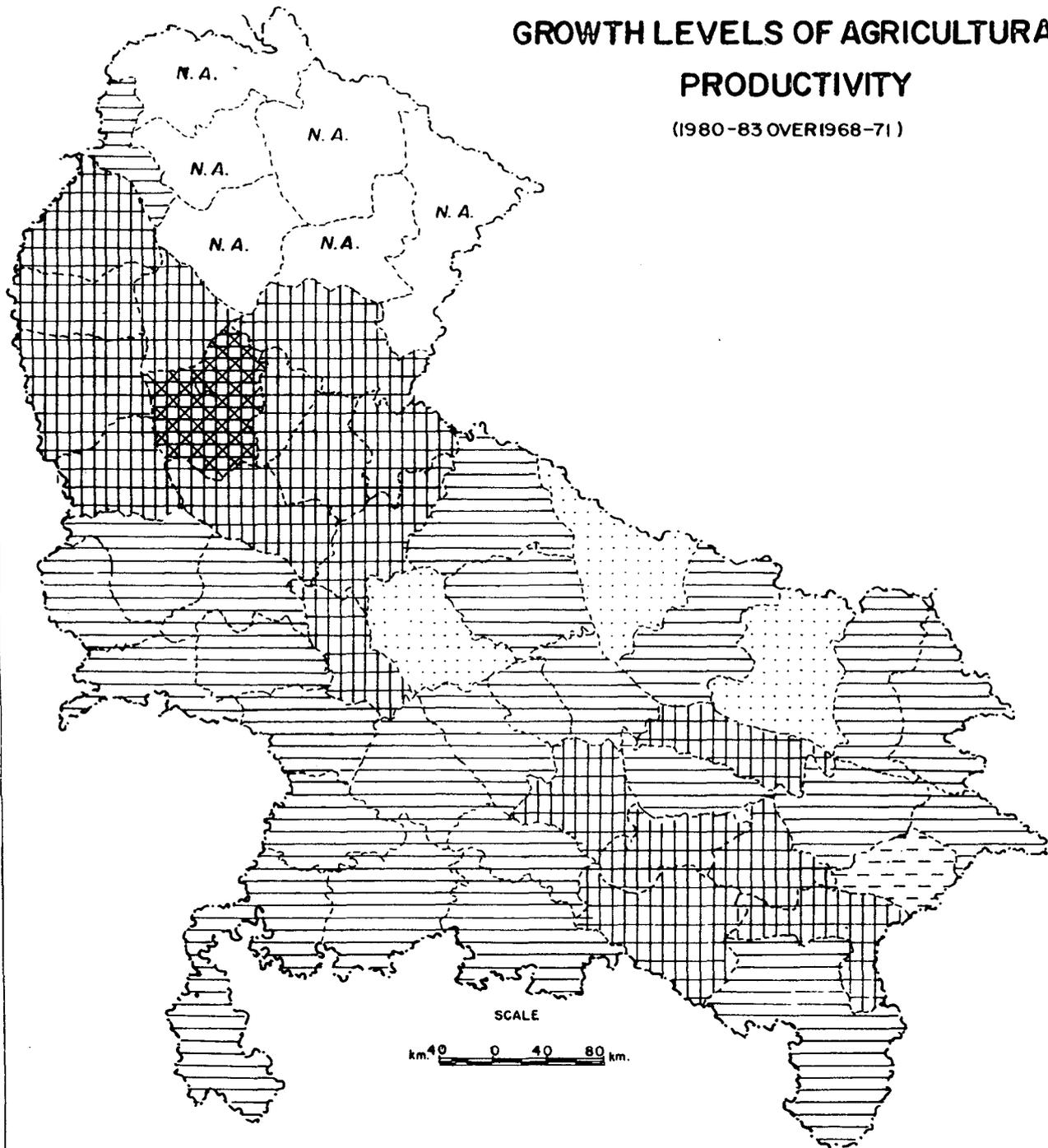
V. HIGH		6.0 and above
HIGH		4.5 - 6.0
MEDIUM		3.0 - 4.5
LOW		1.5 - 3.0
V. LOW		Less than 1.5
N. A.		DATA NOT AVAILABLE
NEGATIVE		-0.40 - -0.45

FIG. 3-4

UTTAR PRADESH

GROWTH LEVELS OF AGRICULTURAL PRODUCTIVITY

(1980-83 OVER 1968-71)



ANNUAL COMPOUND GROWTH RATE IN PERCENT

V. HIGH		6.0 and above
HIGH		4.5 - 6.0
MEDIUM		3.0 - 4.5
LOW		1.5 - 3.0
V. LOW		Less than 1.5
N. A.		DATA NOT AVAILABLE
NEGATIVE		- 0.74

Table 3.2

GROWTH LEVELS OF AGRICULTURAL PRODUCTIVITY
(Annual Compound Growth Rate in %)

Category	1968-71 over 1960-63	1980-83 over 1968-71	1980-83 over 1960-63
Above 6.0 (Very high)	30 (One district)	-	-
4.5-6.0 (High)	-	14 (One district)	-
3.0-4.5 (Medium)	41, 13, 15, 45, 6, 10, 16, 14, 9. (Nine districts)	18, 22, 4, 17, 5, 29, 12, 43, 47, 16, 36, 39, 3, 15, 2, 11, 13, 27. (Eighteen districts)	14, 15, 13, 16, 18, 4, 17, 3, 2, 36, 12. (Eleven districts)
1.5-3.0 (Low)	44, 2, 19, 3, 34, 31, 1, 4, 38, 37, 32, 36, 18, 12, 17, 20, 33, 40, 7, 42, 8. (Twenty-one districts)	35, 33, 46, 42, 24, 20, 32, 19, 48, 8, 23, 21, 28, 37, 44, 1, 9, 31, 38, 40, 6, 7, 25, 26, 10. (Twenty five districts)	5, 19, 6, 32, 29, 33, 47, 44, 20, 10, 39, 9, 42, 37, 1, 11, 22, 41, 43, 31, 8, 45, 38, 30, 27, 24, 48, 35, 21, 40, 23, 7, 34, 46. (Thirty-four districts)
Below 1.5 (Very low)	5, 11, 48, 47, 29, 21, 39, 25, 23, 24, 27, 35, 26, 43, 28. (Fifteen districts)	45, 34, 41 (Three districts)	28, 25, 26 (Three districts)
Negative	22 (-0.41), 46 (-0.44) (Two districts)	30 (-0.74) (One district)	-

The district-codes correspond to the names listed in Appendix I.

Farrukhabad formed a contiguous region of medium growth rate of productivity in western Uttar Pradesh (see Map 3.6).

The districts of Pilibhit, Shahjahanpur and Badaun have remained in the medium growth category throughout the periods. The district of Moradabad has shown high growth rate of productivity between 1968-71 and 1980-83. Ghazipur is the only district which characterized with a sharp rate of decline (-0.74) in agricultural productivity between 1968-71 and 1980-83. The overall pattern of growth trends in agricultural productivity shows that during sixties, the low productivity districts have shown comparatively high growth than the high productivity districts. But during seventies high productivity districts also shown an effort to increase their productivity levels.

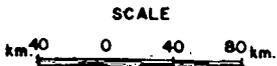
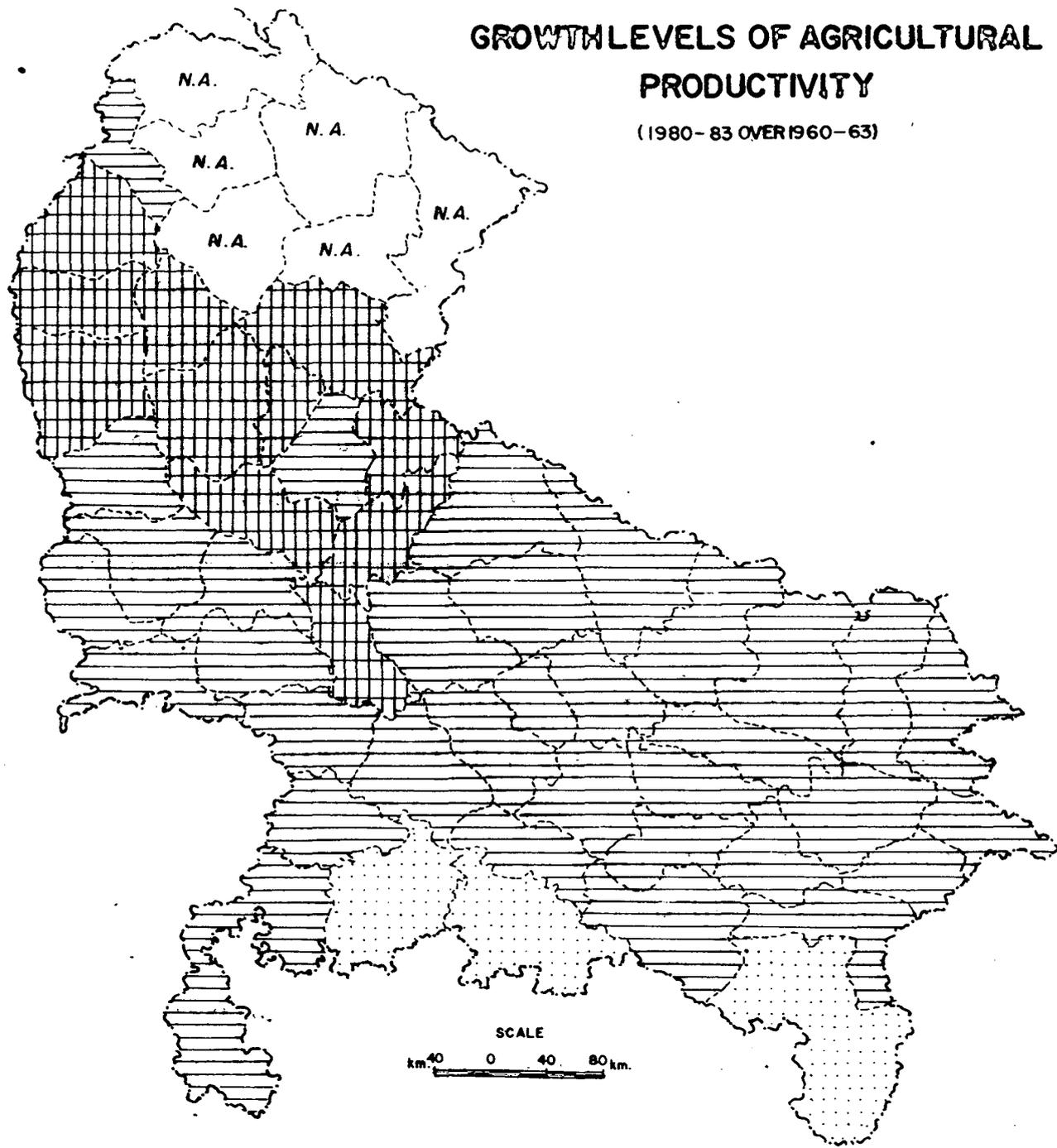
Pattern of the Input Use

In this part of the chapter, the spatial and temporal pattern of the inputs will be discussed in detail. This discussion could help in developing the framework for the analysis of the mutual interrelationship of the explained and explanatory variables.

The fact remains that the growth of crops is primarily a function of complex interaction between a number of natural factors on one hand, and man's decisions and his experience on

UTTAR PRADESH

GROWTH LEVELS OF AGRICULTURAL PRODUCTIVITY
(1980-83 OVER 1960-63)



ANNUAL COMPOUND GROWTH RATE IN PERCENT

V. HIGH		6.0 and above
HIGH		4.5 6.0
MEDIUM		3.0 4.5
LOW		1.5 3.0
V. LOW		Less than 1.5
N. A.		DATA NOT AVAILABLE

FIG. 3-6

the other. The physical environment exercises influence through the variations in relief, soil and the whole set of climatic parameters. The human effort which makes crop growth possible is constrained by the institutional framework and the level of technology. These factors interact between themselves fundamentally affecting agricultural productivity and generating variations in it over space as well as time. Thus the regional variations in agricultural productivity mirror the magnitude and the nature of inter-play amongst these factors.³

The new agricultural technology has come up in big way in agriculture sector of the state particularly in western parts. New agricultural technology can be defined as 'the employed or operative knowledge of means of production of particular group of goods and services'.⁴

New technology and use of new inputs such as fertilizers, mechanical devices in agriculture and high yielding varieties of seeds have transformed the agriculture to a great extent in the recent past. These technological changes may be land augmenting and labour saving or even labour absorbing. Three

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3. S.Mohapatra, Agricultural Productivity and Its Determinants: A Case Study of Orissa, unpublished dissertation, 1986, Centre for the Study of Regional Development, JNU, New Delhi, p.85.
 4. Montague Yudelman, et al (1971), Technological Change in Agriculture in Developing Countries (Paris, OECD), p.36.

important components of new agricultural technology i.e., Fertilizer, Irrigation and mechanisation have been selected to explain the variations in agricultural productivity in the present study.

Fertilizer: Soil acts as a source of plant nutrient. The nutrients are liable to exhaust due to continuous cultivation. It may not be possible even for fertile soils to supply plant nutrients in sufficient quantity for long without becoming impoverished.⁵ For the optimum plant growth and maximum crop-yields, it is necessary that all the essential nutrients must be present in optimum condition in the soil during cultivation. So, the depleted soil has to be restored with the necessary nutrients at the required levels, otherwise the productivity of the soil will decline.

The chemical fertilizers are a source of plant nutrient. Next to water, fertilizers constitute the second vital input contributing to agricultural productivity. The chemical fertilizers protect the land fertility by meeting the nutrient-deficiency of soil and provide necessary nutrient requirements to crops if used with combination of other inputs. Thus, it leads to higher agricultural productivity.

5. Department of Agriculture, Government of Tamil Nadu,
Report of the Committee on Agriculture Production.

Consumption Levels of Fertilizers

The average consumption of Fertilizers per hectare of cropped area in Uttar Pradesh is 27 kgs. which is slightly above the all India average of 20.8 kgs. during mid-seventies. But the consumption of fertilizers is not uniform everywhere in the state during all the three time periods. The levels of fertilizer use are given below.

1960-63: The per hectare fertilizer consumption was very low in the state during 1960-63. As it is evident from Table 3.3, all districts were confined to the very low category of fertilizer consumption. The fertilizer consumption varied from 7.22 kgs per hectare in Farrukhabad to 0.106 kgs. in Hamirpur during 1960-63 (Appendix VII).

1968-71: The fertilizer consumption has shown an increase in some of the districts in the state during 1968-71. There are nine districts which have shown an increase in the level of fertilizer consumption. These are Muzaffarnagar, Meerut, Saharanpur, Nainital, Gorakhpur and Deoria. Other 39 districts still remained in the category of very low fertilizer consumption during this period ranged from 46.39 kgs. per hectare in Muzaffarnagar to 1.69 kgs. per hectare in Hamirpur (Appendix VIII).

1980-83: The fertilizer consumption per hectare has gone up phenomenally during this period. The variations in consumption

among districts also became sharp in this period. It varied between as high as 135 kgs. per hectare in Nainital and as low as 2.77 kgs. per hectare in Pithoragarh (Appendix IX). The average fertilizer consumption in the state is 62.43 kgs. per hectare which is higher than all India average of 30 kgs per hectare. The districts of Nainital and Meerut fall in the category of very high consumption of fertilizers. The category of high consumption includes the districts of Saharanpur, Muzaffarnagar, Ghaziabad, Bulandshahr, Rampur, Pilibhit, Farrukhabad and Lucknow where the consumption varies from 107.48 kgs per hectare to 90.3 kgs per hectare. The medium category of consumption comprises of 13 districts, where consumption ranges from 86.54 kgs. per hectare in Faizabad to 62.44 kgs. per hectare in Sultanpur.

The overall pattern of fertilizer consumption levels reflects a trend of upward movement of districts from low to high and very high categories, between 1960-63 and 1980-83. As can be observed from the Table 3.3, all the districts were concentrated in the very low category during 1960-63. In 1968-71, nine out of 48 districts moved to the low category and remaining 39 districts remained in the very low category as in 1960-63. During 1980-83, a fair number of districts moved into the higher categories and spread among all categories. Thus, 1980-83 experienced a sharp and conspicuous increase in the levels of fertilizer consumption in the state.

Table 3.3

FERTILIZER CONSUMPTION
(Kgs per hectare)

Category	1960-63	1968-71	1980-83
Above 120 (Very high)	-	-	36, 4. (Two districts)
90-120 (High)	-	-	55, 3, 5, 17, 18, 2, 37, 16 (Eight districts)
60-90 (Medium)	-	-	43, 27, 12, 30, 33, 29, 31, 47, 15, 14, 11, 19, 46 (Thirteen districts)
30-60 (Low)	-	3, 4, 43, 36, 48, 33, 5, 2, 32 (Nine districts)	48, 32, 42, 13, 8, 6, 39, 22, 9, 20, 35, 38, 21, 7, 34, 10, 44, 40, 41, 28 (Twenty districts)
Below 30 (Very low)	All districts (48) Max. 7.22; Minimum, 0.106.	34, 18, 27, 29, 17, 44, 12, 14, 46, 47, 11, 37, 16, 31, 1, 6, 22, 13, 30, 35, 20, 19, 9, 10, 15, 8, 7, 39, 42, 40, 24, 28, 45, 21, 41, 38, 23, 26, 25. (Thirty-nine districts)	24, 1, 23, 56, 52, 26, 25, 49, 54, 51, 45, 53, 50. (Thirteen districts)

The district-codes correspond to the names listed in Appendix I.

The districts of Nainital and Meerut are characterised with high growth in fertilizer consumption and jumped from the medium and high categories to very high category between 1968-71 and 1980-83. The districts which moved into the high category from the low category within the same periods, are Muzaffarnagar, Ghaziabad, Bulandshahr, Saharanpur, Rampur, Pilibhit, and Farrukhabad in the West and Lucknow in Central parts of the state. There are 13 other districts which witnessed increase in their consumption levels of fertilizer between 1968-71 and 1980-83.

Twenty districts in the low category during 1980-83 have experienced only marginal increase. The remaining 13 districts falling in the very low category have shown an insignificant increase in their fertilizer consumption level.

Irrigation: Needless to say irrigation plays an important role in the development of agriculture. Irrigation is one of the fundamental factors in the adoption of the package strategy. It encourages multiple cropping, intensive and effective use of land and raises the agricultural production of an area. Availability of assured water supply for irrigation is a pre-condition for the application of other improved inputs of agricultural technology like HYV seeds, chemical fertilizers and pesticides and insecticides.⁶

6. H.Davis (1966), The Development of Agriculture in Spain, IBRD and FAO, Washington, D.C., p.1.

In the present study, irrigation - an explanatory variable is taken in terms of proportion of gross irrigated area to gross cropped area.

1960-63: Irrigation has an important factor in the study area even before 'Green Revolution'. This is an obvious conclusion of Table 3.4 which shows proportion of gross irrigated area to gross cropped area. During 1960-63, half of the districts were in the low (20-40 per cent) category of proportion of irrigated area. The second major group was of very low proportion of irrigated area consisting of 14 districts of the state. Only Meerut and Muzaffarnagar districts were in the high category. Remaining eight districts were in medium category where the level of irrigation was between 40 and 60 per cent (Table 3.4).

The western districts of Uttar Pradesh adjoining Haryana Delhi and Rajasthan form a contiguous region of high and medium levels of irrigation. Similar contiguous region is formed by the district of Faizabad, Azamgarh, Jaunpur and Varanasi.

1968-71: The concentration of districts remained in the low category during this period also, as 23 districts continued to remain in this category. The importance of medium category has increased as 15 districts are lying in this category as compared to eight in the previous time period. Irrigation in the state is showing improvement in its levels as only six districts are left in the very low category of proportion.

Table 3.4

PROPORTION OF GROSS IRRIGATED AREA
(Irrigated area in %)

Category	1960-63	1968-71	1980-83
Above 80 (Very high)	-	4, 3. (Two districts)	4, 55, 5, 3 (Four districts)
60-80 (High)	4, 3 (Two districts)	5, 6. (Two districts)	6, 2, 7, 14, 9, 36, 27, 16, 17, 19, 10, 12, 37 (Thirteen districts)
40-60 (Medium)	5, 6, 29, 35, 43, 27, 7, 1 (Eight districts)	7, 2, 10, 9, 43, 29, 19, 27, 33, 1, 34, 39, 14, 35, 8. (Fifteen districts)	15, 38, 39, 8, 43, 30, 18, 35, 20, 11, 33, 48, 1, 47, 32, 41, 31, 29, 13, 34, 46, 21, 28. (Twenty-three districts)
20-40 (Low)	34, 10, 9, 47, 19, 30, 46, 39, 32, 33, 31, 2, 18, 8, 36, 37, 48, 20, 21, 28, 38, 14, 24, 44 (Twenty-four districts)	37, 47, 30, 31, 12, 46, 32, 11, 18, 36, 13, 24, 48, 20, 38, 21, 15, 16, 28, 22, 17, 44, 23. (Twenty-three districts)	22, 40, 56, 52, 51, 44, 42, 23, 24, 26. (Ten districts)
Below 20 (Very low)	22, 13, 26, 23, 11, 12, 41, 25, 15, 40, 16, 17, 45, 42 (Fourteen districts)	40, 41, 26, 25, 42, 45. (Six districts)	49, 25, 53, 45, 50, 54. (Six districts)

The district-codes correspond to the names listed in Appendix I

The districts of Meerut and Muzaffarnagar have moved from high to very high category during this period. Similarly, the districts of Bulandshahr and Aligarh have also shown upward movement from medium to high category.

1980-83: This is a period of uniform distribution of districts among all categories of proportion of irrigated area (Table 3.4). During this period, maximum number of districts (23 out of 56) are concentrated in the medium category of proportion and high and low categories with 17 and 16 districts respectively. The districts which have made comparatively more efforts to increase their irrigation level are Lucknow, Rampur, Pilibhit and Bijnor which have moved up in the high category from the low category. During this period, the districts of Meerut, Ghaziabad, Bulandshahr and Muzaffarnagar are lying in the very high category. However, except Bulandshahr, the other districts were already in the same category during 1968-71.

The overall distribution pattern of districts among all five categories does not show a very clear trend in the increase in levels of irrigation during all three periods of time. The districts which have made remarkable efforts to increase the proportion of irrigated area are Nainital, Bulandshahr, Rampur, Pilibhit and Lucknow, which were in low category of proportion in first two periods, shifted to the high category during 1980-83.

Mechanization: Introduction of high yielding varieties of seeds for different crops along with adequate water and chemical fertilizers has made possible a larger harvest and multiple cropping. These miracle seeds can show their production potential if all the operations of farming are conducted at the proper time. For example, seed-bed preparation should be of good quality and done at proper time, there should be uniform application of fertilizers, assured irrigation at proper time and proper quantity, harvesting and threshing should be early to sow the next crop. All the operations mentioned above if performed with traditional human and animal energy can neither be satisfactory nor be finished in time. Therefore, timely farm operations of satisfactory quality can only be achieved by using sufficient and well-adopted machinery and implements.⁷

Thus, mechanization speeds up the agricultural operations and reduces the drudgery. It improves the operation and significantly raises the productive capacity. But mechanization in Indian agriculture is of recent origin and the level is low. From a purely technical angle, the power requirements of Indian agriculture are estimated about 112 million h.p. or 0.8 h.p. per hectare. As against this estimated requirement, the available power for use in Indian agriculture has been

7. A.N. Sadhu and R.K. Mahajan (1985), Technological Change and Agricultural Development in India, Himalayan Publishing House, Delhi, p.44.

estimated at 28 million h.p. or 0.2 h.p. per hectare. Of this available power 75 per cent is supplied by draught animals in the country. This gap of power requirements can be filled up only through mechanisation.⁸

In Uttar Pradesh the growth in mechanical inputs in farming practices is of recent origin. But, with the introduction of commercial agriculture, the farmers are adopting it on an increasing scale. A healthy trend in the growth of mechanization has emerged in the state particularly in the western districts.

The present study considers oil engines, electrical pumpsets, tractors and ploughs (iron and wooden) only, for evolving an index of mechanisation, as complete data are available for these four variable only. The index has been evolved, converting these above mentioned variables into a common unit of wooden plough equivalent (as estimated by ICAR).⁹ Levels of Mechanization expressed in terms of wooden plough equivalent.

1960-63: Mechanisation was very low throughout the state during this period. The mechanisation index (WPe per thousand hectare) was very low during 1960-63, which varies only between

8. W.B. Donde, "Tractors in Indian Agriculture", Agricultural Situation in India, vol.24, April 1969, p.391.

9. M.H.Qureshi and A.Mathur, (1985), A Geo-Economic Evaluation for Micro-Level Planning, p. 46.

755.61 per thousand hectares and 198 per thousand hectares with a mean of 410.68 per thousand hectares (Appendix VIII). During this period, all districts are confined to the category of very low mechanisation index (Table 3.5). Even the district of the highest index value (755.61) i.e., Azamgarh falls in the category of very low level of mechanization.

1968-71: This is a period of late 'Green Revolution' and experienced a noticeable increase in the level of mechanization. The index value in this period ranges from 1718.86 per thousand hectare in Nainital to 209.33 per thousand hectare in Jhansi (Appendix VIII). The districts of Nainital, Muzaffarnagar and Gorakhpur fall in the category of medium index value of mechanisation. The major concentration of the districts (34 out of 48) in the low category (Table 3.5). Remaining eleven districts fall in the category of very low mechanisation index.

1980-83: The mechanisation index value widely varies among the districts during this period. It ranges from 3500 per thousand hectare in Muzaffarnagar to 532 per thousand hectares in Hamirpur with a mean of 1759 per thousand hectares. The districts of Muzaffarnagar and Meerut are characterised with very high index of mechanisation. While the districts of Saharanpur, Bijnor and Ghaziabad fall in the category of high index value. The major concentration of the districts (24 out of 56) lies in the category of medium index value. The second

Table 3.5

MECHANIZATION INDEX
(WPe per thousand hectares)

Category	1960-63	1968-71	1980-83
Above 3200 (Very high)	-	-	3, 4. (Two districts)
2400-3200 (High)	-	-	12, 2, 55. (Three districts)
1600-2400 (Medium)	-	36, 3, 32. (Three districts)	36, 35, 18, 49, 50, 14, 43, 34, 54, 17, 15, 32, 16, 37, 42, 30, 29, 8, 19, 33, 9, 11, 38, 27. (Twenty-four districts)
800-1600 (Low)	-	2, 19, 35, 16, 12, 43, 4, 42, 18, 15, 27, 11, 20, 41, 40, 17, 9, 37, 34, 29, 13, 8, 21, 38, 1, 33, 30, 48, 39, 45, 47, 28, 22, 10. (Thirty four districts)	44, 13, 5, 47, 48, 7, 39, 1, 41, 6, 20, 10, 31, 46, 21, 22, 52, 45, 28, 51, 40, 24. (Twenty-two districts)
Below 800 (Very low)	All districts (Forty-eight districts)	14, 44, 7, 5, 46, 31, 6, 26, 24, 25, 23. (Eleven districts)	23, 53, 26, 56, 25. (Five districts)

The district-codes correspond to the names listed in Appendix I.

major concentration of districts can be observed in the category of low mechanisation index during 1980-83 (Table 3.5). Remaining five districts, falling in the category of very low mechanisation index, form a contiguous region of very low mechanisation over Bundelkhand region of the state.

The overall pattern of levels of mechanisation in all the periods, shows that there is a conspicuous trend of shift of districts from low to high categories between 1960-63 and 1980-83. There is only three districts i.e. Nainital, Muzaffarnagar and Gorakhpur which have shown a phenomenal increase in mechanisation index, jumped up to medium from the very low category between 1960-63 and 1980-83. The major concentration of districts also has shown a gradual shift from very low to low and low medium between the first and second and second and third period respectively.

Cropping Intensity: Cropping intensity is defined as per cent ratio of gross cropped area to net sown area, which shows the extent of multiple cropping in a particular region. Intensity of cropping reflects the efficiency of agricultural land-use. It increased the agricultural production from the same land. It also helps in diversification of cropping pattern. The intensity of cropping shows a strong positive relationship with intensity of irrigation and as a result it has positive correlation with agricultural productivity in the state.

Levels of cropping intensity in the state during all three periods are given below.

1960-63: The low and medium categories comprised of 24 and 20 districts respectively. Only Nainital fell in high intensity category while none of the districts fell in very high category of intensity. The district of Jhansi, Jalaun and Hamirpur fell in the very low intensity of cropping. It means majority of the districts are characterised with medium level of cropping intensity during 1960-63 (Table 3.6).

1968-71: During 1968-71 the medium intensity category dominates the scene as it comprises of 24 districts, while in the low category only 16 districts are there. In the very low category same three districts of Jhansi, Jalaun and Hamirpur are present as in 1960-63. The high category contained four more districts (total five districts) namely Aligarh, Bulandshahr, Meerut, and Dehradun (Table 3.6).

1980-83: During this period, the low and very low categories combinedly accounted for only 5 districts - 3 in very low and 2 in low categories. The same three districts of Bundelkhand are still present in the very low category of intensity. The districts of Lalitpur and Banda fell in the category of low intensity of cropping. The high intensity category gets the highest number of districts (23 out of 56) during 1980-83. Second highest number of districts fall in the medium intensity category.

Table 3.6
CROPPING INTENSITY
(GCA/NCA x 100)

Category	1960-63	1968-71	1980-83
Above 160 (Very high)	-	-	50, 49, 36, 5, 55, 6, 51, 4. (Eight districts)
145-160 (High)	36 (One district)	36, 6, 5, 4, 1 (Five districts)	16, 10, 2, 17, 44, 52, 3, 48, 54, 1, 43, 32, 31, 45, 53, 33, 34, 35, 18, 14, 9, 29, 11. (23 districts)
130-145 (Medium)	48, 4, 44, 5, 1, 43, 17, 2, 45, 27, 39, 6, 34, 10, 32, 46, 3, 28, 9, 38. (Twenty districts)	2, 37, 3, 17, 33, 10, 48, 44, 43, 16, 9, 34, 27, 45, 32, 39, 38, 19, 11, 31, 18, 46, 29, 14. (24 districts)	27, 46, 30, 15, 19, 7, 38, 47, 13, 37, 22, 40, 39, 28, 42, 41, 8, 12, 21, 20 (Twenty districts)
115-130 (Low)	33, 47, 42, 40, 31, 37, 16, 11, 22, 18, 35, 19, 29, 30, 41, 20, 7, 21, 26, 15, 12, 8, 14, 13. (24 districts)	15, 41, 42, 7, 40, 30, 12, 22, 35, 28, 47, 13, 8, 21, 20, 26. (Sixteen districts)	56, 26 (Two districts)
Below 115 (Very low)	23, 24, 25 (Three districts)	23, 24, 25 (Three districts)	23, 24, 25 (Three districts)

The district-codes correspond to the names listed in Appendix I.

The overall pattern of cropping intensity in all periods shows that it has increased phenomenally in almost all the districts except the districts in Bundelkhand during 1980-83. Table 3.6 reveals that more than 90 per cent (51 out of 56) districts are concentrated in high and medium categories.

Irrigation Intensity: Irrigation intensity is a per cent ratio of gross irrigational area to net irrigated area. Intensity of irrigation shows a strong positive relationship with intensity of cultivation and in result of this, its index value has direct relationship with agricultural productivity.

From Table 3.7, it can be observed that there is no marked change in the irrigation intensity over three periods of time. In all the three periods the low and very low categories are more important than these three categories of medium high and very intensity. In the first two periods of time there were no districts in the high and very high categories. These two categories have joined four and six districts respectively during 1980-83. In the medium category there was only one district during 1960-63 which increased to five in 1968-71 and to six districts in 1980-83. In the very low category there is a continuous decline in the number of districts - 35, 18 and 16 - during three periods of time respectively.

Table 3.7
IRRIGATION INTENSITY
(GIA/NIA x 100)

Category	1960-63	1968-71	1980-83
Above 70 (Very high)	-	-	49, 51, 54, 52, 50, 53. (Six districts)
50-70 (High)	-	-	55, 4, 16, 36. (Four districts)
30-50 (Medium)	1 (One district)	1, 2, 3, 4, 5 (Five districts)	1, 2, 3, 5, 17, 27. (Six districts)
10-30 (Low)	37, 48, 9, 10, 39, 2, 18, 6, 3, 5, 36, 4. (Twelve districts)	6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 26, 27, 30, 33, 36, 37, 39, 44, 48. (Twenty five districts)	6, 7, 9, 10, 11, 12, 14, 15, 18, 19, 20, 21, 22, 26, 28, 30, 31, 33, 37, 38, 39, 42, 43, 48. (Twenty four districts)
Below 10 (Very low)	25, 32, 34, 46, 45, 11, 14, 16, 40, 24, 27, 35, 8, 15, 30, 44, 22, 29, 47, 28, 33, 13, 38, 31, 17, 41, 42, 26, 43, 20, 7, 19, 12, 21, 23. (Thirty-five districts)	8, 23, 24, 25, 28, 29, 31, 32, 34, 35, 38, 40, 41, 42, 43, 45, 46, 47. (Eighteen districts)	8, 13, 23, 24, 25, 29, 32, 34, 35, 40, 41, 44, 45, 46, 47, 36. (Sixteen districts)

The district-codes corresponds to the names listed in Appendix I.

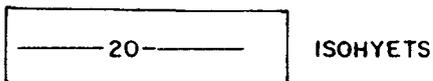
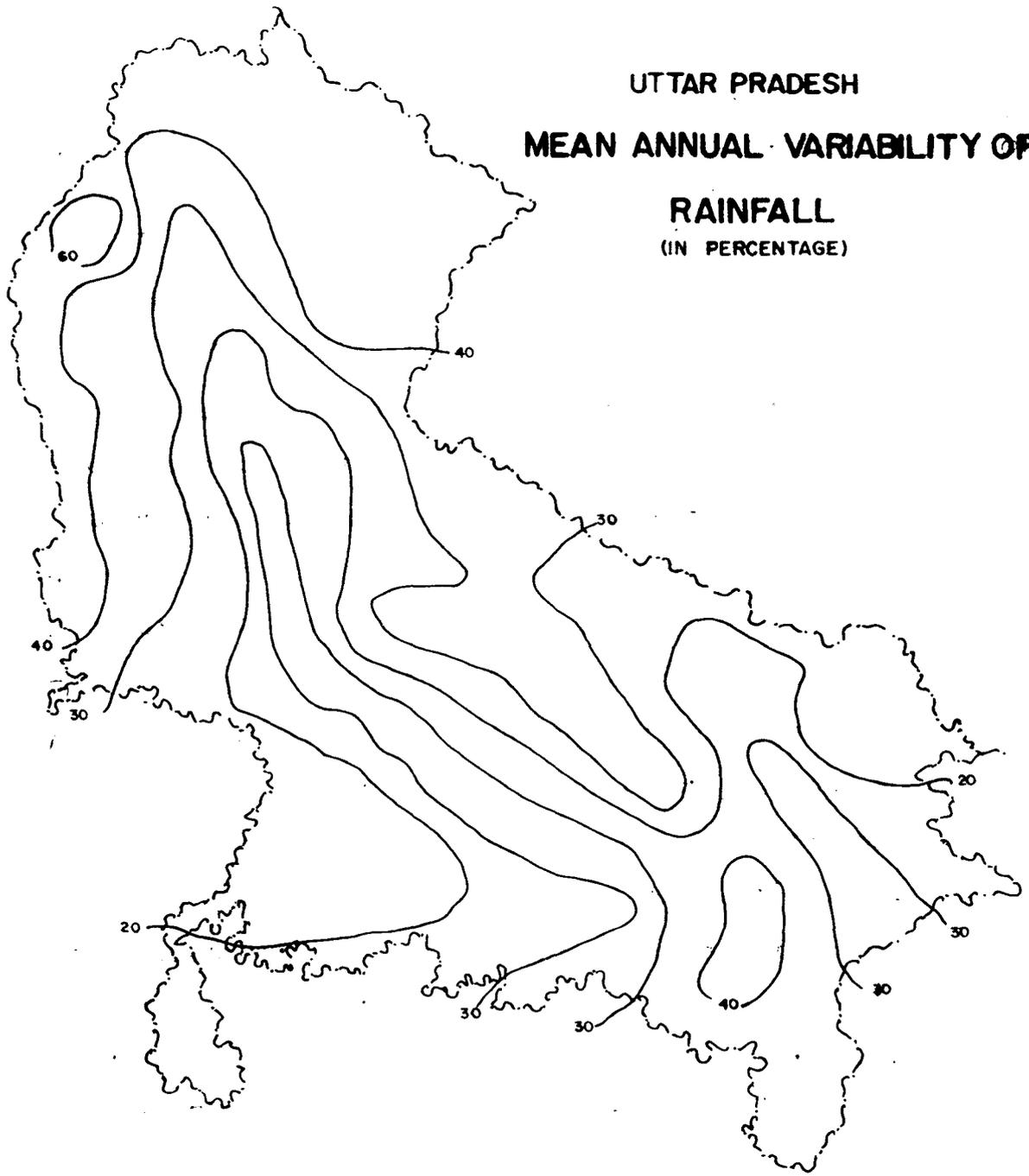
In the low category, an increase of 13 districts can be observed between 1960-63 and 1968-71 while one district declined in 1980-83 (total 24 districts). The north-western hilly districts and most of the western districts of the state show a medium to very high intensity of irrigation.

Variability of Rainfall: In India, the agricultural operations, to a large extent, depend upon rainfall. It affects the cropping pattern, land utilisation pattern and yield of different crops. The total rainfall at different places is subject to great variation from year to year, but for agricultural purposes the wet monsoon is more significant than the annual deviation. On the other hand, long dry spells are dangerous to agricultural development. The inadequacy of moisture in July and August in the study area results in crop failures. The rainfall in the monsoon of September and October is important for the sowing of rabi crops as well as to the quality and yield of kharif crops. Heavy rainfall in these months may delay the sowing of rabi crops and due to excess moisture in the soil and water logging.¹⁰

The mean annual variability of rainfall ranges between 12 and 44 per cent at Allahabad and Mathura respectively (Appendix XII). In the view of Shafi M. "Places with rainfall

10. Ali Mohd (1978), Situation of Agriculture, Food and Nutrition in Rural Area, Concept Publishing Co., Delhi, p.25.

UTTAR PRADESH
MEAN ANNUAL VARIABILITY OF
RAINFALL
(IN PERCENTAGE)



SOURCE - CENSUS ATLAS OF UTTAR PRADESH, 1971.

FIG. 3-7

variability of 12 per cent and more is liable to the occurrence of drought and in this respect most of the areas of the state with the exception of small pockets in the south and north-east susceptible to drought".¹¹

The Appendix XII) reveals that the variability is high in the month of June in Uttar Pradesh. It is about 40 per cent at the stations of Bulandshahr, Jhansi and Allahabad and varies between 35 to 50 per cent at stations of Roorkee (35), Jaunpur (37.5) and Mathura (45). The least variability is reported invariably at all stations of the state in the months of July and August. The variability less than 10 per cent is also not uncommon (5.5 per cent at Jalaun and 10 per cent at Kheri). The variability in the month of September varies from 52 per cent to 62 per cent in Ballia and Meerut respectively. The variability at other stations during this month is also considerably high. The maximum variability levels is noticed in the month of October ranging between 80.5 and 60.5 per cent at Bulandshahr and Etawa stations respectively. Thus, it is evident that the rainfall is most variable in the months of October and June and less variable in September.

The map of mean annual variability (Fig 37) depicts a region trend of rainfall variability which shows an increasing rainfall variability towards north-western parts of the state. The rainfall variability is low in hill and plateau regions of the state.

Chapter IV

ANALYSIS OF THE DETERMINANTS OF AGRICULTURAL PRODUCTIVITY

In the present study, a step-wise regression analysis has been attempted, to have a better explanation of the dependent variable, by all its possible explanatory variables. In this chapter, the step-wise regression exercise along with correlation matrix has been done to get the possible prediction by which larger part of the variations in productivity can be explained.

In the stepwise regression analysis, a series of intermediate regression equations are obtained, one for each addition of variable, until all variables are added and the final regression equation is reached. The variables are added in order of their improvement to the overall goodness of fit and the intermediate regression equation provides the best values of the coefficient for the specific variables included in the equations. Thus at each step, a regression equation is provided, which is the optimum for the included variable.¹

Thus, whenever a multiple regression analysis is attempted, it is useful to know as to how the parameters get

1. D.P.Hauser (1974), "Some Problems in the Use of Stepwise Regression Techniques in Geographical Research", The Canadian Geographer, vol.18(2).

changed when new variables are added, one by one, in the model. This procedure helps in many ways.

Firstly, it tells us the contribution of an added variable in explaining the dependent variable (by seeing the changes in the value of R^2). Secondly, it helps to see whether the new variable is worth including in the model or not (by seeing the changes in the value of \bar{R}^2). It also helps us in keeping a watch over the changes in the values of the regression coefficients and their standard errors.

The explanatory variables, considered best suitable to explain the variations in agricultural productivity, dependent variable, are following for all three periods (1960-63, 1968-71 and 1980-83).

X_1 = Fertilizer consumption in terms of tonnes per 000 hectares G.C.A.

X_2 = Proportion of gross Irrigated area to the gross cropped area

X_3 = Mechanisation index in terms of W.P.e per 000 hectare*

Y = Dependent variable, agricultural productivity in value terms

A. Determinants of Agricultural Productivity During 1960-63

Correlation Matrix: The Table 4.1 reveals that the agricultural productivity had strong positive correlation with

*For mechanisation index: wooden plough equivalent per thousand hectares was taken and all the agricultural implements were converted into wooden plough equivalent.

Table 4.1
CORRELATION MATRIX (1960-63)

Y	X ₁	X ₂	X ₃
1.000	.643*	.538*	-0.77
	1.000	.472	.113
		1.000	.122
			1.000

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

fertilizer consumption and the proportion of irrigated area to gross cropped area. The correlation coefficient values are 0.643 and 0.538 for fertilizer consumption and the proportion of gross irrigated area to gross cropped area respectively, which are significant at 1 per cent level of significance. The third variable, mechanisation index, on the other hand, is correlated with agricultural productivity but the relationship is not significant. r value is -0.077 for mechanisation index, which is insignificant even up to 5 per cent level of significance. It is evident from the table that fertilizer consumption and proportion of gross irrigated area are inter-correlated significantly.

Results of the Step-wise Regression Analysis

The order in which the independent variables are added is given in Table 4.2. The fertilizer consumption entered at

Table 4.2
STEP-WISE REGRESSION ANALYSIS (1960-63)

Variable	R	R ² x100	Increase in R ² x 100	\bar{R}^2	F	Regression coefficient	S.E.of estima- tes	t	Inter- cept
1	2	3	4	5	6	7	8	9	10
Step 1									
X ₁	.643	41.4	-	.414	32.5*	290.1	501.32	5.70*	1888.75
Step 2									
X ₁	.696	48.5	7.1	.474	21.18*	225.82	480.33	4.13*	1648.61
X ₂						12.36		2.49*	
Step 3									
X ₁	.717	51.5	3.0	.493	15.55*	231.47		4.30*	
X ₂						12.98	476.76	2.65**	1988.92
X ₃						-0.89		-1.64	

*Significant at 1 per cent level of significance

**Significant at 5 per cent level of significance

X₁ Fertilizer consumption /000 hectares

X₂ Proportion of gross irrigated area to gross cropped area.

X₃ Mechanisation index in terms of W.P.E. /000 hectares.

the first step and accounted for 41.4 per cent of the total variations in productivity during 1960-63. R value is significant at 1 per cent level of significance. Regression coefficient for fertilizer consumption at first step, is also significant at 1 per cent level of significance. Proportion of gross irrigated area to gross cropped area, which is introduced at second step, together with fertilizer consumption, explains 48.5 per cent of areal variations in productivity. R value at second step (0.696) is significant at 1 per cent level. Regression coefficient for fertilizer consumption at the second step is significant at 1 per cent level of significance, however for proportion of gross irrigated area to gross cropped area it is significant at 5 per cent level of significance. The last predictor added at third step, is the mechanisation index which together with fertilizer consumption and proportion of gross irrigated area to gross cropped area explains 51.5 per cent of variations in productivity. R value (0.717) is significant at 1 per cent level of significance. However, regression coefficient for mechanisation index is insignificant. Regression coefficient at step 3, for fertilizer consumption and proportion of gross irrigated area to gross cropped area is significant at 1 per cent and 5 per cent levels of significance.

The value of standard error of estimate is fairly high through out the model which decreases marginally in second and

third steps. \bar{R}^2 value increases in second and third steps and shows that though the contribution of the mechanisation index is very poor but it can be retained in the analysis, as it has caused a significant increase in \bar{R}^2 .

With the overall results, it can well be concluded that the functional relationship between agricultural productivity and the explanatory variables except mechanisation index which shows relatively low explanatory power to explain the areal variations in agricultural productivity during 1960-63. This may be due to following facts.

(a) The mechanisation index might not have been sensitive to explain the variations during 1960-63, pre-Green Revolution period, when the level of mechanisation was low and farmers worked with their traditional agricultural implements.

(b) This may be because of a significant inter-correlation between fertilizer consumption and proportion of gross irrigated area to gross cropped area.

B. Determinants of Agricultural Productivity During 1968-71

Correlation Matrix: Table 4.3 shows that all independent variables have positive and significant correlation with agricultural productivity. Fertilizer consumption has the highest r value (.699), which is significant at 1 per cent level of significance. Proportion of gross irrigated area

Table-4.3

CORRELATION MATRIX: 1968-71

Y	X ₁	X ₂	X ₃
1.000	.699*	.664*	.413*
	1.000	.626	.346
		1.000	.130
			1.000

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

to gross cropped area and the mechanisation index are also correlated significantly with agricultural productivity. r values for the proportion of gross irrigated area to gross cropped area (0.664) and the mechanisation index are significant at 1 per cent level. Fertilizer consumption and proportion of gross irrigated area to gross cropped area are strongly inter-correlated and on the other hand fertilizer consumption and the mechanisation index are intercorrelated moderately.

Results of the Step-wise Regression Analysis

Fertilizer consumption, which got introduced at first step, explains 48.9 per cent of the variations in agricultural productivity during 1968-71. R value (0.699) is significant at 1 per cent level of significance. Regression coefficient

(53.88) is also significant at 1 per cent level of significance. At step 2, proportion of gross irrigated area to gross cropped area together with fertilizer consumption explains 57.3 per cent of areal variations in agricultural productivity. R value (.757) is significant at 1 per cent level of significance. Regression coefficients for fertilizer consumption and proportion of gross irrigated area to gross cropped area are significant at 1 per cent level of significance (Table 4.4).

The mechanisation index, which got introduced at the last step, explains only 4.8 per cent of variations in agricultural productivity. All three variables together explain 62.1 per cent of total areal variations in agricultural productivity. At step 3, R value (0.788) is significant at 1 per cent level of significance. Regression coefficient for mechanisation index is significant at 5 per cent level of significance. Regression coefficient for fertilizer consumption and proportion of gross irrigated area to gross cropped area are significant at 1 per cent level of significance.

The value of \bar{R}^2 increases and the value of standard estimate (S.E.) decreases throughout the model which suggests to include all three variables in the model. Thus the set of three variables explained 62.1 per cent of the variations in agricultural productivity. As it has been mentioned earlier that variables: fertilizer consumption (X_1) and proportion of

Table 4.4

STEPWISE REGRESSION ANALYSIS (1968-71)

Variables	R	R ² x 100	Increase in R ² x 100	R ⁻²	F	Regression coefficient	S.E. of estimate	t	Inter- cept
Step 1									
X ₁	.699	48.9	-	.489	44.03*	53.88	624.15	6.64*	1822.54
Step 2									
X ₁	.757	57.3	8.4	.564	30.22*	35.96	582.96	3.74*	1477.51
X ₂						17.99		2.98*	
Step 3									
X ₁	.788	62.1	4.8	.604	23.99*	28.12		2.88*	
X ₂						19.60		3.38*	963.34
X ₃						0.60		2.34**	

*Significant at 1 per cent level of significance

**Significant at 5 per cent level of significance

X₁ Fertilizer consumption per 000 hectares

X₂ Proportion of gross irrigated area to gross cropped area

X₃ Mechanization index in terms of W.P.E. per 000 hectares.

gross irrigated area to gross cropped area (X_2) together explain 57.3 per cent variation and their regression coefficients are significant at 1 per cent level of significance. The mechanisation index explained only 4.8 per cent variations and its regression coefficient (0.60) is significant at 5 per cent level instead of 1 per cent level of significance. The value of f ratio is significant till the last step, so the relationship as given in this step is identified as optimal.

With the overall results it can well be concluded that the functional relationship between dependent variable (agricultural productivity (Y)) and the explanatory variables (fertilizer consumption (X_1)) and (proportion of gross irrigated area to gross cropped area (X_2)) is quite strong. The mechanisation index became bit stronger to explain the variations in agricultural productivity during this period. But still, fertilizer consumption (X_1) and proportion of gross irrigated to gross cropped area (X_2) have strong correlation among them and contribute a major explanatory power to explain the variations in agricultural productivity during 1968-71.

C. Determinants of Agricultural Productivity During 1980-83

Correlation Matrix: Table 4.5 reveals that the values of correlation coefficient for all three independent variables are significant at 1 per cent level of significance. Proportion

Table 4.5
CORRELATION MATRIX: 1980-83

Y	X ₁	X ₂	X ₃
1.000	.498*	.837*	.473*
	1.000	.474	.152
		1.000	.282
			1.000

*Significant at 1 per cent level of significance

**Significant at 5 per cent level of significance

of gross irrigated area to gross cropped area (X_2) gets the highest coefficient of correlation with agricultural productivity. r value is +0.84 for proportion of gross irrigated area to gross cropped area (X_2), which is significant at 1 per cent level of significance. Fertilizer consumption (X_1) and mechanisation index (X_3) also have fairly high values of correlation coefficient, which are significant at 1 per cent level of significance. Fertilizer consumption and mechanization index have moderate correlation with the proportion of gross irrigated area to gross cropped area.

Results of Stepwise Regression Analysis

Proportion of gross irrigated area to gross cropped area (X_2), which got introduced at first step, explains 70.1 per cent of variations in agricultural productivity during 1980-83. R value (0.837) for this initial variable (X_2) is significant at

1 per cent level of significance (Table 4.6). Regression coefficient (57.15) for the initial variable at Step 1 is fairly high and significant at 1 per cent level of significance. At step 2, mechanization index (X_3) together with proportion of gross irrigated area to gross cropped area (X_2) explains 76.2 per cent of total variation in agricultural productivity. 'R' value (0.87) at second step, is significant at 1 per cent level of significance. Regression coefficient values for mechanization index (X_3) as well as proportion of gross irrigated area to gross cropped area (X_2) are significant at 1 per cent level of significance. Contribution of mechanization index is low, i.e., 6.1 per cent. But regression coefficient for mechanization index can be tested at 1 per cent level of significance. Fertilizer consumption (X_1), which is introduced at last step, together with proportion of gross irrigated area to gross cropped area (X_2) and mechanization index (X_3), explains 77.4 per cent of areal variations in agricultural productivity during this period (1980-83). Contribution of fertilizer consumption in areal variations of agricultural productivity, is very low, i.e., 1.2 per cent. Regression coefficient for fertilizer consumption is also insignificant up to 5 per cent level of significance. But regression coefficient for other two variables, proportion of gross irrigated area to gross cropped area (X_2) and mechanization index (X_3) are significant at even 1 per cent level of

Table 4.6

STEPWISE REGRESSION ANALYSIS (1980-83)

Variable	R	R ² x 100	Increase R ² in x 100	R ²	F	Regress- ion coeffi- cient	S.E. of estimate	t	Intercept
Step 1									
X ₂	.837	70.1	-	.701	126.31*	57.15	860.27	11.24*	939.69
Step 2									
X ₂	.873	76.2	6.1	.757	84.65*	52.20	781.91	10.94*	351.49
X ₃						0.48		3.69*	
Step 3									
X ₂						48.21		9.15*	
X ₃	.880	77.4	1.2	.765	59.25*	0.47		3.71*	341.59
X ₁						3.52		1.67	

*Significant at 1 per cent level of significance

**Significant at 5 per cent level of significance

X₁ Fertilizer Consumption per 000 hectares

X₂ Proportion of gross irrigated area to gross cropped area

X₃ Mechanization index in terms of W.P.E. per 000 hectares

significance. 'R' value (0.88) at Step 3, is significant at 1 per cent level of significance (Table 4.6).

Table 4.6 shows that \bar{R}^2 value increases till last step and suggests the validity of lastly added variable, fertilizer consumption. A study of \bar{R}^2 , however, shows that though the contribution of fertilizer consumption is very poor in R^2 but it can be retained in the analysis, as it has caused a marginal increase in \bar{R}^2 . Further, standard error of estimate (S.E.) is fairly high through out the model but decreases marginally in second and third steps.

With the overall results it can well be concluded that the functional relationship between productivity and the explanatory variables considered is very strong. As it is evident from Table 4.6, that proportion of gross irrigated to gross cropped area (X_2) alone explains more than 70 per cent variation in productivity, it became possible because of new innovations in agricultural technology. During this period, mechanization index got entered into second place, after proportion of gross irrigated area to gross cropped area. During earlier two periods (1960-63 and 1968-71), fertilizer consumption had a major explanatory power to explain the variations in agricultural productivity. But its explanatory power got reduced during 1980-83 because of very strong influence of proportion of gross irrigated area to gross cropped area and mechanization index.

It is evident from an overall analysis of explanatory variables and agricultural productivity for all three periods that the explanatory power of all three independent variables has increased from 51.5 per cent in first period (1960-63) to 62.1 and 77.4 per cent in second and third periods (1968-71 and 1980-83), respectively. It means all or at least some of the independent variables have been getting a positive change in their explanatory powers, with change of time. Proportion of gross irrigated area to gross cropped area (X_2), has been a second big explanatory power after fertilizer consumption during first two periods but in the third period (1980-83) it emerged as a first big explanatory power for explaining the variation in agricultural productivity. In the same way, mechanization index has been a third rank explanatory variable during first two periods but became a second important explanatory variable during third period (1980-83).

On the other hand, fertilizer consumption which had leading role in explaining the variations in agricultural productivity experienced a sharp decline in its explanatory power. Thus, it can be said that explanatory power of fertilizer consumption has declined with change in time and it is probably because of an exorbitant prices of chemical fertilizers and an advent of use of machinery in a big way in agricultural sector.

Chapter V

SUMMARY AND CONCLUSION

There has been a substantial increase in the production of foodgrains and as a strategy, importance is being given to enhance the agricultural productivity. The state of Uttar Pradesh has also experienced an increase in the agricultural productivity levels. Therefore, in the present study, an attempt has been made to analyse the agricultural productivity and its determinants in the state.

In Uttar Pradesh, the scope for physical expansion of cultivated land is limited and the only way out for increasing production is the intensive use of land and raise the yield of crops per unit of land. Rice, wheat and sugarcane among five major crops taken for study have shown a marked increase in their yields between 1960-63 and 1980-83 while rest two crops - barley and maize - have not shown much improvement in the yield levels. The western districts of Uttar Pradesh have experienced more improvement in the yield of the crops than other districts. The crops which have shown a marked increase in their yields with passage of time, are wheat, rice and sugarcane. The districts of Bundelkhand have shown poor yield levels of crops throughout the periods. The districts Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Etawa, Moradabad, Rampur, Kanpur have experienced a very significant

increase in the yields of wheat. The districts which have shown low increase in the yield of wheat are Jhansi, Banda, Mirzapur, and hill districts of Uttar Kashi, Tehri Garhwal, Garhwal, Chamoli and Almora. A marked improvement in the yield levels of rice are experienced in the districts of Saharanpur, Muzaffarnagar, Muradabad, Rampur, Bareilly, Bijnor, Shahjahanpur, Pilibhit, Nainital, Meerut, Kanpur, Barabanki, Varanasi, Deoria and hill district of Uttar Kashi.

The yield pattern of sugarcane shows a continuous increase in the number of districts in the high yield categories and a consistent decline in low categories in successive time periods. Dehradun, Muzaffarnagar, Meerut, Saharanpur, Nainital, Moradabad, Kanpur, Bareilly, Pilibhit, Shahjahanpur, Gorakhpur, Unnao and Rae Bareilly are the districts of high yield levels of Sugarcane. Low yield levels of sugarcane have been noticed in the districts of Garhwal, Pithoragarh, Jalaun, Jhansi, Lalitpur, Hamirpur, Banda, Mirzapur and Mathura during 1980-83.

The yield per hectare of barley is considerably high in the districts of Aligarh, Etawa and Kanpur. The district of Gonda experienced a very low yield of barley. During first two periods, the yield levels of barley remained almost the same but during third period (1980-83) the yield per hectare increased and the districts of Allahabad, Faizabad, Rae Bareilly, Bareilly, Etah, Kanpur, Bulandshahr, Muzaffarnagar and Mainpuri shown an improvement in the yield levels of barley. The

district which have showed comparatively high yield levels of barley consistantly in all the periods are mainly Mathura, Agra, Etawa , and Agra.

The yield of maize was comparatively high in the districts of central and eastern Uttar Pradesh during first two periods and in third period (1980-83). Western districts experienced a significant increase in the yield of maize and shifted to high categories of yield. This happened mainly because of an introduction of HYVs of seed along with assured irrigation in western Uttar Pradesh.

Agricultural productivity varies over both space and time in the state. During 1960-63 all districts in Eastern Uttar Pradesh except Deoria, Central Uttar Pradesh except Barabanki and Faizabad and south western districts of Uttar Pradesh formed a contiguous region of very low agricultural productivity. In 1968-71, the number of districts in the very low category got reduced to twenty-five as twelve districts moved up to the low category. A further decline of twelve districts was observed during 1980-83 in the very low category and at the same time the productivity pattern of 1980-83, revealed that the districts were dispersed in all the five categories and had uniform pattern of distribution.

The analysis of growth trends in agricultural productivity shows that during sixties the districts of low agricultural productivity have shown comparatively higher growth rates than

high productivity districts. But during seventies high productivity districts have also shown increase their productivity levels.

Many factors are responsible for the variations and uneven growth of agricultural productivity in the state their relationship with the productivity is complex and complete deciphering is difficult. The present study takes three predictors - mechanisation, proportion of irrigated area and fertilizer consumption which all together explain more than three fourth of total variations in agricultural productivity in Uttar Pradesh.

The new agricultural technology has come in a big way in agricultural sector in some parts of the state. New agricultural technology and use of new inputs such as consumption of fertilizers, mechanical devices in agriculture and high yielding varieties of seeds have transformed the agriculture to a great extent in recent past. The major contribution in transforming the agriculture in the state, made by the use of chemical fertilizers, assured irrigation along with high yielding varieties of seeds.

The chemical fertilizers protect the land fertility by meeting the nutrient deficiency of soil and provide necessary nutrient requirements to crops. The fertilizer consumption trend shows that there is an upward movement of districts from

very low to very high category between 1960-63 and 1980-83. This shows that per hectare consumption of fertilizers has increased with passage of time. The consumption of fertilizers per hectare gross cropped area in Uttar Pradesh is 27 kgs. which is more than that of all India average of 20.8 kgs. But the consumption is not uniform throughout the state. It varies between 135 kgs per hectare in Nainital and 2.77 kgs per hectare in Pithoragarh.

Assured supply of water for irrigation is a condition for the adoption of new agricultural technology and development. The overall analysis on irrigation shows that provision of irrigated area in maximum districts was low during 1960-63. Thereafter in successive periods the proportion of irrigated area started to increase as concentration of the districts shifted to higher categories during 1968-71 and 1980-83. The state as a whole could not make any marked improvement in irrigation levels but only Western Uttar Pradesh got very high irrigation levels during later periods.

The third predictor - mechanisation - speeds up the agricultural operations and raised the agricultural productivity in the state significantly. There is a conspicuous improvement in mechanisation levels between 1960-63 and 1980-83 as an upward shift of districts from low categories to high and very high categories has been noticed between these two periods.

Main findings are briefly summarized below:

The agricultural productivity is not uniform throughout the state but it varies from one region to another. The western parts of the state show fairly high level of agricultural productivity and thus, its gradient is due south and south east during 1960-63 and 1968-71 and this gradient became more steep during the third period (1980-83).

The temporal changes in agricultural productivity indicate that districts with low levels of productivity over periods of time, are making effort to increase it, while the districts with high levels of productivity have reached a stage of plateau. But this is true only for first two periods, because during third period, the districts of high productivity, also made a significant growth in agricultural productivity. Actually during post-Green Revolution period progress has been made only in those districts where the infrastructure for such progress was already available and instead of extensified progress only intensified progress was made.

In the field of technological inputs (fertilizer consumption, irrigation and mechanisation) intensified progress was made largely in western Uttar Pradesh. Eastern Uttar Pradesh could not make much progress in the use of technological inputs in agriculture and remained sadly neglected. Irrigation facilities are again available in abundance in western Uttar Pradesh in contrast to the lack of irrigation facilities in

eastern Uttar Pradesh which has accentuated regional disparity in agricultural development.

The yield per hectare of cultivated land is much more in western districts than the eastern districts of low infra-structural facilities for agricultural development. The crops which experience more variations in their yields between western and eastern districts, are wheat, rice and sugarcane. Barley and maize are such crops which have experienced less spatial as well as temporal variations in the state. These crops have shown less improvement in their yield, over period of time and this is because of low preferences given to these crops by farmers.

✓ The analysis of simple correlation and stepwise regression show the extent of relationship and contribution of explanatory variables to the variations in agricultural productivity in the state. 'F' and 't' tests determine the significance of the predictors at each step.

During 1960-63, all the explanatory variables taken together explained 51.5 per cent of the total variations in agricultural productivity. 'R' was significant at 1 per cent level of significance. Regression coefficient values were also significant at 1 and 5 per cent levels of significance. With these results it is concluded that variables considered here fairly high explanatory power to explain the spatial

variations in agricultural productivity during 1960-63. The fertilizer consumption was a dominant variable which alone explains as much as 41.4 per cent of variations.

In the second period 1968-71, the explanatory power of all predictors increased to 62.1 per cent with the dominant contribution of fertilizer consumption followed by proportion of gross irrigated area to gross cropped area (X_2). 'R' values are significant at 1 per cent level of significance. Regression coefficient values are significant at 1 and 5 per cent levels of significance. Thus, with the help of these results it can well be concluded that predictors are getting increased in their explanatory power over period of time.

In the third period all the predictors together explained 77.4 per cent of total variations in agricultural productivity in the state. During this period, irrigation became dominant over fertilizer which alone explains 70.1 per cent of variations in agricultural productivity. The mechanisation index became second important explanatory power next to irrigation in this period. 'R' values are significant at 1 per cent level of significance at each step. Regression coefficient values are also significant at 1 per cent level. This shows, all taken predictors together are able to explain more than three fourths of total variations in agricultural productivity.

Books

- Agrawal, A.N.(1960), Indian Agriculture, Vikas Publishing House Ltd., Delhi.
- Agarwal, Bina (1983), Mechanization in Indian Agriculture: An Analytical Study Based on the Punjab, Allied Publishers Private Ltd., Delhi.
- Ali, Mohd. (1979), Dynamics of Agricultural Development in India, Concept Publishing, Delhi.
- _____ (1978), Situation of Agriculture Food and Nutrition in Rural India, Concept Publishing, Delhi.
- _____, "Regional Imbalances in Levels of Agricultural Productivity," in Noor Mohammad (ed.), (1980), Perspectives in Agricultural Geography, vol.IV, Concept Publishing, Delhi.
- Arnon, I (1981), Modernization of Agriculture in Developing Countries, John Wiley, New York.
- Aslam, Mahmood (1977), Statistical Methods in Geographical Studies Rajesh Publications, New Delhi.
- Banerjee, S.(1987), Regional Imbalances in the Agricultural Development in U.P., Sudha Publication, Varanasi.
- Bansil, P.C. (1977), Agricultural Problems of India, Vikas Publishing House, Ltd., Delhi.
- Bhardwaj, K.(1974), Production Conditions in Indian Agriculture, Cambridge University Press.
- Bhalla, G.S. and Y.K.Alagh (1977), Foodgrains Growth: A Districtwise Study, Jawaharlal Nehru University, New Delhi (mimeo).
- _____ (1979), Performance of Indian Agriculture, A Districtwise Study, Sterling Publishing Pct.Ltd., New Delhi.
- Bhalla, G.S.(1974), Changing Agrarian Structure in India: A Study of the Impact of Green Revolution in Haryana, Meenakshi Prakashan, Meerut.
- Chaudhury, P.(1972), Readings in Indian Agricultural Development, Allen and Unwin, London.
- Chopra, R.N.(1986), Green Revolution in India (A Study of Punjab, Haryana, UP and Bihar), Intellectual Publishing, New Delhi.
- Coward and Walter Jr.(eds.) (1980), Irrigation and Agricultural Development in Asia, Ithaca, Cornell University Press.

- Dantwala, M.L. and Others (eds.) (1986), Indian Agricultural Development Since Independence (A Collection of Essays), Oxford and IBH Publishing Co.Pvt.Ltd., New Delhi.
- Das, Manmohan (1984), Peasant Agriculture in Assam: A Structural Analysis, Inter-India Publications, New Delhi.
- Desai, M., Rudolph, S.H. and Rudra, A. (1984), Agrarian Power and Agricultural Productivity in South Asia, Oxford University Press, Delhi.
- Deshpande, A. and Bapat, S.B. (eds.), (1980), Indian Agriculture: Performance and Potential, Jaico, Bombay.
- Dubhashi, P.R. (1986), Policy and Performance: Agricultural and Rural Development in Post Independence India, Sage Publications, New Delhi.
- Giriappa, S. and Vivekanand, M. (1984), Agricultural Development in India, Ashok Publishing House, Delhi.
- Gosh, R.N. (1977), Agriculture in Economic Development, Vikas, New Delhi.
- Hussain, Majid (1979), Agricultural Geography, Inter-India Publication, New Delhi.
- Indian Council of Agricultural Research, Handbook of Agriculture, New Delhi, 1964.
- Kahlon, A.S. (1984), Modernization of Punjab Agriculture, Allied Publishers, New Delhi.
- Kakde, J.R. (1985), Agricultural Climatology, Metropolitan Co., N. Delhi.
- Ladejinsky, Wolf, Agricultural Production and Constraints, World Development Report, vol. IV, Pergmon, Press, 1976.
- Lekhi, R.K. (1986), Agricultural Development in India, Classical Publishing Company, New Delhi
- Lewis, W.A. (1955), Theory of Economic Growth, George Allen and Unwin, London.
- Minhas and Vaidyanathan, "Growth of Crop Output in India, 1951-54 to 1958-61 - An Analysis by Component Elements", Primit Chaudhary, ed. 1972 Reading in Indian Agricultural Development George Allen and Unwin, Blackal India,
- Misra, G.C. and Singh O.N. (1979), "Impact of High Yielding Varieties and Fertilizers in Paddy and wheat Cultivation - A Case Study in the Eastern Uttar Pradesh" in Agricultural Research and Rural Development, published by Society of Agriculture, vol. 2, (1&2), Banaras Hindu University, Varanasi.
- Mishra, Pratibha (1984), Soil Productivity and Crop Potentials: A Case Study of District Alwar, Rajasthan, Concept, New Delhi.

- Mukhopadhyay, S.K. (1976), Sources of Variation in Agricultural Productivity - Cross-Section Time Series Study, MacMillan Co., India, New Delhi.
- Naidu, K.M. (ed), (1984), Area Planning for Regional Development, Inter-India Publications, New Delhi,
- Nair, K.N.S. (1980), Technological Changes in Agriculture - Impact on Productivity and Employment, New Delhi.
- Nalini, Govind (1986), Regional Perspectives in Agricultural Development: A Case Study of Wheat and Rice in Selected Regions of India, Concept Publishing Company, New Delhi.
- Noor, Mohd. (1978), Agricultural Land Use in India, Inter-India Publications, Delhi.
- Pacey, Arnold and Philip Pyne, (1985), Agricultural Development and Nutrition, Hutchinson, London.
- Rai, S.P. (1985), Contribution of Irrigation to Agricultural Production and Productivity, National Council of Applied Economic Research, New Delhi.
- Pandit, Somnath (1983), Critical Study of Agricultural Productivity in Uttar Pradesh - 1951-75, Concept Publishing Company, New Delhi.
- Pillai, P.P. (ed.), (1982), Agricultural Development in Kerala, Agricole Publishing Academy,
- Qureshi, M.H. and Mathur, A. (1985), A Geo-Economic Evolution for Micro-Level Planning: A Case Study of Gurgaon District, Concept Publishing Company, New Delhi.
- Raju, V.T. (1982), Impact of New Agricultural Technology on Farm Income Distribution and Employment; National Publishing House, New Delhi.
- Ramayya, S. "Stagnation in Agricultural Productivity" in S.C. Jain (ed) (1966), Changing Indian Agriculture, Vora and Company Publications Ltd.
- Rangaswami, P. (1982), Dry Farming Technology in India: A Study of Its Profitability in Selected Areas, Agricole Publishing Academy, New Delhi.
- Rao, C.H. Hanumantha (1975), Technological Change and Distribution of Grains in Indian Agriculture, The Macmillan Company of India Ltd., New Delhi.

- Rao, G.N. (1983), Statistics for Agricultural Sciences, Oxford and IBH Publishing Co., New Delhi.
- Rao, V.K.R.V., "Agricultural Production and Productivity During Plan Period - A Review of the Past and Some Reflections on Future", in Khusro, A.M. (ed.), Readings in Agricultural Development, Bombay, Allied Publishers, 1968.
- Sadhu, A.N. and Mahajan, R.K. (1985), Technological Change and Agricultural Development in India, Himalaya Publishing House, Delhi.
- _____ and Amarjit Singh (1980), New Agricultural Strategy: Its Implications, Marwah Publications, New Delhi.
- Saini, G.R. (1979), Farm Size, Resource Use Efficiency and Income Distribution (A Study in Indian Agriculture with Special Reference to Uttar Pradesh and Punjab) Allied Publishers Pvt. Ltd., New Delhi.
- Sarkar, P.C. (1966), Planning of Agriculture in India, Rotterdam University Press.
- Schultz, T.W. (1964), Transforming Traditional Agriculture, New Hawana, Yale University Press.
- Sen, Sunil (1979), Agrarian Relations in India (1793-1947), People's Publishing House, New Delhi.
- Shafi, Mohd. (1984), Agricultural Productivity and Regional Imbalances - A Study of Uttar Pradesh, Concept Publishing Company, New Delhi.
- _____ (1972), Agricultural Geography - A Trend Report A Survey of Research in Geography, Indian Council of Social Science Research, New Delhi
- Shah C.H. and Sawant, S.D. (1982), Towards New Horizons in Agricultural Production: 2000 A.D., Oxford and IBH Publishing Co., New Delhi.
- Sharma, A.C. (1976), Mechanization of Punjab Agriculture Eurasia Publishing House (P) Ltd., New Delhi
- Sharma, P.S. (1973), Agricultural Regionalization in India New Heights Publications, Delhi.
- Siddiqi, Asiya (1973), Agrarian Change in Northern Indian State Uttar Pradesh, 1819-1833, Oxford at the Clarendon Press.

- Singh, G.B. (1979), Transformation of Agriculture, Vishal Publications, Kurukshetra.
- Singh, Jasbir (1974), A Green Revolution in India - How Green It Is, Vishal Publishing, Kurukshetra.
- _____ (1975), An Agricultural Atlas of India - A Geographical Analysis, Vishal Publishing, Kurukshetra.
- _____ and Sharma, V.K. (1985), Determinants of Agricultural Productivity in Haryana: A Sample Study of Operational Holdings for Landuse Planning, Vishal Publications, Kurukshetra.
- _____ (1976), An Agricultural Geography of Haryana, Vishal Publications, Kurukshetra.
- Singh, Shrinath (1976), Modernization of Agriculture (A Case Study in Eastern Uttar Pradesh), Heritage Publishers, New Delhi
- Swarup, R., Sikka, B.K. (1983), Agricultural Development in Himachal Pradesh, Agricole Publishing Academy, Agro-Economic Research Centre, H.P. University, Shimla.
- Views of Eminent Economists and Agricultural Experts (1984), Agricultural Development and the Small Farmers, S.Chand and Co.Ltd., New Delhi.
- Yudemen, Montague Butler and Govan Banerjee, Ranadev (1979), Technological Change in Agriculture and Employment in Developing Countries, Paris, OECD.

Articles

- Ali Arzal, et.al, "Indian Agriculture in 2000 - Strategy for Equality", Economic and Political Weekly, vol.16, no.10, March 1981.
- Ali, Mansoor and Pant S.K., "Productivity Variation in Agriculture - A Case Study of Chamoli District (U.P.)", Agricultural Situation in India, vol.39, no.8, November 1984.
- Arya, S.R.S. and Shah, S.L., "New Technology of Rainfed Agriculture and Identification of Constraints on Its Adoption in Mid-hills of U.P.", Agricultural Situation in India, October 1984, p.487.

- Bapat Shailaja, "Irrigation in India", Economic Times, 25 January 1984, p.5.
- Bergman, T., "Problems of Mechanization in Indian Agriculture", Indian Journal of Agricultural Economics, vol.18, no.1, October-December 1963.
- Bagchi, A.K., "Growth of Agricultural Production", Economic and Political Weekly, Bombay, Annual Number, January 1965.
- Bhatia, M.S., Sharma, V.K. and Hague T, "Changes in Factor Relations and Productivity in Indian Agriculture", Agricultural Situation in India, vol.38, no.10, January 1984.
- Brijesh, K., Bajpai, "Regional Disparities in Agricultural Productivity, An Outcome of Based Infrastructure: A Case Study of Allahabad District, U.P.", Agricultural Situation in India, vol.39, no.2, May 1984.
- Chandra, D.R., Tiwari, C.B. and Singh, G.N., "Vertical Growth for Agriculture - A Regional Analysis of Uttar Pradesh", Agricultural Situation in India, vol.38, no.6, September 1983, p.389.
- Chatterji and P. Maitreya, "Some Aspects of Region Variation in Agricultural Productivity in West Bengal," Indian Journal of Agricultural Economics, vol.19, January-March 1964.
- Dandekar, V.M., "Regional Variations in Agricultural Development", Indian Journal of Agricultural Economics, vol.19, 1964.
- , "Summary of Group Discussions on Regional Variations in Agricultural Development", Indian Journal of Agricultural Economics, vol.19, 1964, p.264.
- Dhondhayal, S.P., "Regional Variations in Agricultural Development and Productivity in Uttar Pradesh", Indian Journal of Agricultural Economics, vol.19, January-March 1964-65.
- Gopal, M.D. and Rao, T.R., "Regional Variations in Agricultural Productivity in Andhra Pradesh", Indian Journal of Agricultural Economics, vol.19, January-March 1964.
- Hausar, D.P., "Some Problems in the Use of Stepwise Regression Techniques in Geographical Research", The Canadian Geographer, vol.18, no.2, 1974.

- Hussain, M. A., "A New Approach to the Agriculture Productivity Regions of the Sutlej-Ganga Plains of India", Geographical Review of India (36) 3, 1976, pp.230-34.
- Jain, H.K. and Singh, D., "Impact of the New Agricultural Technology", Agricultural Situation in India, vol.38, no.10, January 1984.
- Kundu, Amitabh, "Construction of Composite Index", Geographical Review of India, March 1975.
- Kuznets, Simon, "Economic Growth and Contribution of Agriculture, Notes on Measurement," International Journal of Agrarian Affairs, vol.3, no.2, April 196, pp.56-57.
- Kendall, M.G., "Geographical Distribution of Crop Productivity in England", Journal of the Royal Statistical Society, 102, 1939, pp.21-62.
- Kaul, J.L. and Johl, S.S., "Differentials in Productivity Growth in Punjab," Agricultural Situation in India, 22(1), 1967, pp.3-7.
- Maitry, T. and Roy, B., "Regional Variations in Yield Per Acre of Major Crops in India - 1950-51 to 1959-60", Indian Journal of Agricultural Economics, vol.19, January-March 1964-65, Conference Number.
- Mukherjee, A.B., "Agricultural Geography of the Upper Ganga-Yamuna Doab", Indian Geographer, 11(2), 1965.
- Narain, Dharam, "Growth of Productivity in Indian Agriculture", Indian Journal of Agricultural Economics, vol.32, no.1, January-March 1977, pp.1-4.
- Noor, M. and Thakur, R., "Spatial Variations and Determinants of Agricultural Productivity in Bihar," in Noor Mohammad (ed.), Perspectives in Agricultural Geography vol.4, Concept, New Delhi, 1980.
- Rajagopalan, V., "Summary of Group Discussions on Long Term Prospects of Agricultural Growth Viewed in the Light of Social Climatic, Technological and Institutional Constraints and Cost Involved in Their Removal", Indian Journal of Agricultural Economics, vol.36, no.1, January-March 1981.
- Raj, K.N., "Agricultural Growth in China and India," Economic and Political Weekly, vol.15, no.4, 24 January 1983.

- Rao, C.H. Hanumantha, "What is Wrong with Indian Agriculture", Conspectus, vol.2, no.2, 1966, pp.11-19.
- Rao, A.P., "Size Holding and Productivity", Economic and Political Weekly, vol.2, no.44, November 1967.
- Rao, S.K., "Inter Regional Variation in Agricultural Growth 1953-54 to 1964-65 - A Tentative Analysis in Relation to Irrigation", Economic and Political Weekly, July 1971
- Saiwal, Sneh, "Dynamics of Crop Diversification in Aravali Region", Annals of the Association of Rajasthan Geographers, 6 (Annual), December 1986, pp.23-76.
- Sen, Anartya L., "Size of Holdings and Productivity", Economic and Political Weekly, vol.16, February 1964.
- Sen, S.R., "Growth and Instability in Indian Agriculture", Agricultural Situation in India, vol.21, no.10, January 1967.
- Shafi, M., "A New Approach to the Delimitation of Food Productivity Regions in India," International Geographical Congress Abstracts, no.2, Canada, 1972.
- , "Measurement of Agricultural Efficiency in Uttar Pradesh", Economic Geography, vol.36, 1960, p.304.
- , "Measurement of Agricultural Productivity of Great-Plains of India," The Geographer, vol.19, 1972, pp.4-13.
- , "Perspective on the Measurement of Agricultural Productivity", The Geographer, vol.21, no.1, 1974.
- Singh, A.K. (1984), "District Profile of Agriculture in Uttar Pradesh," Agricultural Situation in India, vol.38, no.11, February 1984, pp.703-13.
- Sharma, P.S., "A Regional Approach to Agricultural Development in India - Some Primary Remarks", Indian Journal of Agricultural Economics, vol.19, January-March 1969
- Singh, J.L.K. and Bhatnagar, S.Q., "Determinants of Farmer's Sugarcane Acreage Allocation Decision in U.P.", Agricultural Situation in India, vol.38, no.7, October 1983, p.453.

- Singh, Jasbir, "A New Technique of Delimiting Agricultural Production Typology in Food Crop Dominating Economy Haryana Case Study", Geographica Polonica, 40, 1979, p.21.
- Singh, H. ., "Crop Production in India," Agricultural Situation in India, vol.38, no.9, December 1983.
- Spare, S.G. and V.D. Deshpande, "Inter-District Variations in Agricultural Efficiency in Maharashtra State," Indian Journal of Agricultural Economics, 19(1), 1964.
- Srinivasan, T.N., "Trends in Agriculture in India - 1949-50 to 1977-78", Economic and Political Weekly Special Number, 1979.
- Subaiah, S. and Ahmad A., "Determinants of Agricultural Productivity in Tamil Nadu, India", Transaction of Institute of Indian Geographers, no.1, vol.II, 1980, pp.15-32.
- Swaminathan, M.S., "Indian Agriculture at the Cross Roads," Indian Journal of Agricultural Economics, vol.32, no. 4, October-December 1977, pp.1-34.
- Tambal, S.B., "Spatial and Temporal Variations in Agricultural Productivity", Indian Journal of Agricultural Economics, vol.20, no.4, October-December 1965, p.41.
- .Tirupati, Rao Naidu, "Trends in Farm Mechanization During the Post-Green Revolution Period and Associated Variables - An Interstate Analysis", Indian Journal of Agricultural Economics, vol.32, no.4, October-December 1977, p.107.
- Vidya Sagar and Kanta Ahuja, "Agricultural Productivity in Rajasthan: An Inter-Regional and Inter-Temporal Analysis - Preliminary Observations", Indian Journal of Agricultural Economics, vol.32, April-June 1977, pp.33-41.
- Yufero Hayami and Ruttan, V.W., "Agricultural Productivity Differences Among Countries," The American Economic Review, vol.9, no.5, 1970, p.895.

Government Publications

U. P. Government, Lucknow, Season and Crop Reports (1960-83).

_____, Statistical Abstracts, Uttar Pradesh (1960-83)

_____, Economic Surveys (1980-83).

_____, Weekly Bulletin of Prices, Week ending Friday
1981.

Government of India, New Delhi, Reports of National Commission
on Agriculture, Ministry of Agriculture and Irrigation.

_____, Bulletins on Food Statistics, Ministry of
Agriculture and Irrigation.

_____, Fertilizer Statistics, Fertilizer Association
of India (1960-83).

_____, Agricultural Situation in India, 1960-83.

_____, Indian Agriculture in Brief, 1980-83.

Census of India, 1971, Uttar Pradesh, Part II A, General
Population Table Series, 21.

Appendix I

LIST OF DISTRICTS OF UTTAR PRADESH WITH CODE NUMBERS

S.No.	District	Code	S.No.	District	Code
1.	Agra	8	29.	Hardoi	41
2.	Allahabad	22	30.	Jalaun	24
3.	Aligarh	6	31.	Jaunpur	29
4.	Almora	49	32.	Jhansi	23
5.	Azamgarh	35	33.	Kanpur	20
6.	Bahraich	45	34.	Kheri	42
7.	Ballia	31	35.	Lalitpur	56
8.	Banda	26	36.	Lucknow	37
9.	Barabanki	48	37.	Mainpuri	9
10.	Bareilly	11	38.	Mathura	7
11.	Bijnor	12	39.	Meerut	4
12.	Basti	34	40.	Mirzapur	28
13.	Budaun	13	41.	Moradabad	14
14.	Bulandshahr	5	42.	Muzaffarnagar	3
15.	Chamoli	54	43.	Nainital	36
16.	Dehra Dun	1	44.	Pilibhit	16
17.	Deoria	33	45.	Pithoragarh	50
18.	Etah	10	46.	Pratapgarh	47
19.	Etawa	19	47.	Rae Bareli	39
20.	Faizabad	43	48.	Rampur	17
21.	Farrukhabad	18	49.	Saharanpur	2
22.	Fatehpur	21	50.	Shahjahanpur	15
23.	Garhwal	53	51.	Sitapur	40
24.	Ghaziabad	55	52.	Sultanpur	46
25.	Ghazipur	30	53.	Tehri Garhwal	51
26.	Gonda	44	54.	Unnao	38
27.	Gorakhpur	32	55.	Uttar Kashi	52
28.	Hamirpur	25	56.	Varanasi	27

The code numbers of districts are as per the sequence given in the original source, i.e., Season and Crop Reports, Govt. of Uttar Pradesh.

Appendix - II

Districtwise Trinnium Averages of Area under Nineteen Crops in Utter Pradesh

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Rice	Wheat	Barley	Jowar	Bajra	Maize	Gram	Peas	Arhar	Masoor	Urad	Mung	Sugarcane	Potato	Cotton	Groundnut	Seasium	Sarsoan	Tobacco
Dehra Dun	1 61 13746	17664	1807	0	58	9458	1945	570	509	582	906	18	5089	239	31	21	643	445	70
	1 71 12734	22782	2852	0	0	12013	924	436	99	507	1621	14	5815	455	15	114	407	101	65
	1 81 16557	27074	2147	0	0	12860	688	273	84	1107	1495	5	5511	979	0	203	567	802	88
Saharanpur	2 61 88809	120920	4197	559	16558	31026	59507	6358	451	5854	1481	14	77952	896	5010	9902	113	183	324
	2 71 89831	154772	2524	207	13332	38228	25675	4732	296	4662	1346	35	88249	652	4361	11214	214	36	255
	2 81 93586	183728	1179	573	1505	29654	4136	988	135	10112	1066	505	129200	1611	4881	14354	257	1049	250
Muzaffarnagar	3 61 33579	108398	1535	3381	9301	20856	33346	13889	535	2755	949	169	101933	912	4491	11	11	341	295
	3 71 43177	142672	604	682	4667	23992	14109	9079	126	2459	693	54	122505	952	4619	131	7	116	99
	3 81 39563	162704	293	135	460	16126	3379	1364	347	3410	951	78	182725	2079	4717	931	1	902	0
Meerut	4 61 17852	161558	11997	15293	27591	48260	40866	46040	3904	3561	961	74	137890	3559	9992	174	0	229	664
	4 71 31074	216794	5295	3009	20374	68015	25745	29547	1303	3087	694	126	141303	5290	3298	11	4	101	541
	4 81 15753	166471	745	446	3972	30014	3589	2023	774	1881	707	1494	159325	5576	2343	8	2	350	64
Bulandshahr	5 61 5568	105816	59209	23077	47541	61081	26334	56513	8370	2957	326	183	46317	4044	9868	1557	26	961	197
	5 71 11776	184786	60837	12227	38996	103549	23774	33139	3417	1633	511	6148	61294	8051	4159	20	290	4776	0
	5 81 9696	211406	22655	4909	25997	110227	7490	5104	5200	2663	1199	6148	61294	8051	4159	20	290	4776	0
Aligarh	6 61 9221	101539	53644	6828	102769	42726	40421	69760	15610	1352	731	200	20097	2561	13158	1150	37	939	144
	6 71 16248	178437	43923	4129	103422	74141	30683	47237	6631	989	556	10095	18825	5312	2144	486	146	1996	76
	6 81 15179	213134	50668	2348	104350	56271	19067	23493	13034	2035	1550	10095	18825	5312	2144	486	146	1996	76
Agra	7 61 560	80319	35152	29083	52060	6392	63894	14668	14728	868	1494	101	18056	321	7324	121	226	2923	140
	7 71 5078	136155	37090	18214	58398	9483	36650	20672	8401	939	892	10628	17384	2695	4989	14	1948	25673	49
	7 81 3010	168855	36939	4401	73581	4503	12164	6796	5185	1484	1490	69	8874	1796	1554	155	1204	10173	123
Mathura	8 61 1042	73925	36626	13733	100713	1155	92382	11396	30647	153	1092	89	4943	4797	1165	444	403	16401	91
	8 71 2561	117999	21603	8250	110847	4888	68143	16554	24000	112	968	2015	2040	4475	1158	180	1303	68624	36
	8 81 1540	132397	25409	2206	125813	1417	31173	7667	15666	364	1471	52	6796	3890	183	3414	77	1107	381
Mainpuri	9 61 51405	69018	26999	13353	48487	29910	38744	32107	11983	14	234	29	3491	1026	25	9921	199	3040	209
	9 71 49087	110280	15923	10636	48552	85273	32327	21897	8802	31	379	109	1694	1440	29	1600	358	8621	103
	9 81 57238	160057	16159	3211	50319	40901	16658	4374	4670	199	1491	109	1694	1440	29	1600	358	8621	103
Etah	10 61 19769	86674	26755	6774	79134	40575	36051	37480	14359	505	158	70	15487	3412	1604	18860	36	1139	1517
	10 71 23727	123860	16071	8506	80535	59182	27777	31314	19793	415	116	55	10328	4713	1270	18555	138	805	1215
	10 81 25487	157679	14063	3490	84927	47427	17367	18108	8746	1082	369	25548	7894	7776	629	6786	530	10966	3112
Bareilly	11 61 95523	87213	4870	17754	17918	11843	51315	10492	8692	1020	1229	109	38990	1890	50	18279	2	531	440
	11 71 101021	110398	3043	19353	15445	17162	38661	7747	8299	8330	1094	59	39107	1876	3	14271	3	1036	194
	11 81 124123	154279	7319	22468	13623	11597	15378	1935	7813	1554	1581	115	45099	1141	14	10614	159	1471	77
Bijnor	12 61 81760	34428	14238	493	16701	3098	36334	3048	1228	1134	5649	532	65399	546	1754	4673	509	620	266
	12 71 94812	110224	5035	398	3075	8083	25449	1674	1106	1056	6009	174	76916	336	504	18216	371	1779	117
	12 81 81671	127023	2440	157	16790	3676	16141	408	2595	444	3540	380	10355	1548	705	5209	2319	1441	0
Budaun	13 61 29037	137069	18926	13955	77021	23518	47897	26398	20944	1736	1099	54	17426	7907	136	10944	3	1820	468
	13 71 33752	153113	7563	11477	91037	43377	38532	29176	13557	1030	1030	72	19919	8755	176	54002	149	7645	142
	13 81 40724	201389	8448	9351	87395	37294	28518	7968	3164	4135	7515	105	20730	1971	1296	14419	3	147	167
Moradabad	14 61 70226	166275	19514	16138	50771	14183	38968	18253	13706	1600	5466	176	60328	3173	552	27452	9	190	847
	14 71 88178	209033	8568	14368	50951	38626	26719	17249	9839	1774	3796	176	60328	3173	552	27452	9	190	847
	14 81 102476	257201	4793	12855	46355	29575	7451	2721	3072	3073	3047	275	126036	5798	355	13947	915	1902	370
Shahjahanpur	15 61 79847	85991	17492	17542	24125	4894	51635	16132	11617	11148	6502	1119	31295	2458	0	4046	723	791	129
	15 71 80880	114647	10032	16063	26472	9574	39534	11830	10443	5935	5888	820	31840	3132	0	12633	675	3597	84
	15 81 125056	187213	4914	10926	16686	5833	27039	2064	7849	3301	13391	1018	30422	5373	80	5137	1640	7643	118
Pilibhit	16 61 85127	52753	4050	3273	4544	4684	29196	2158	2965	3384	4247	509	13791	366	2	195	220	1172	17
	16 71 89886	73997	3602	2590	4957	5265	20272	1683	2598	7366	2973	107	37125	783	0	1788	408	454	6
	16 81 121778	122083	1164	1857	434	2570	6995	342	2361	9536	3043	187	14009	1472	46	847	1109	7695	0
Rampur	17 61 46317	53315	2245	15075	4337	29836	35469	1640	4698	4628	195	19	29735	968	68	620	1	1617	194
	17 71 52615	76619	1907	16517	5507	31481	24916	1735	4769	4227	151	16	19688	1215	7	1656	0	3163	91
	17 81 73751	98761	555	16946	4087	17429	6815	375	3301	4066	392	75	26119	2741	10	1105	198	5891	1065
Farrukhabad	18 61 26281	79231	22857	29958	21043	44343	39611	18045	12058	356	460	108	11769	12060	149	18672	11	3730	5090
	18 71 24305	106448	14681	20339	19686	73111	30971	9478	8471	1818	5570	441	2309	3974	5	7302	371	12138	157
	18 81 31342	131138	9153	12598	18915	77082	20448	1818	5570	441	2309	3940	3974	38311	5	7302	371	12138	157
Etawah	19 61 49922	55381	24382	12999	55638	22028	45518	34063	18580	6	474	53	7637	1757	713	119	295	50	15114
	19 71 56430	92620	17671	9449	59409	32167	36292	19741	18106	8	62	10	7074	4543	119	295	50	15114	75
	19 81 9004	114033	16480	4810	59106	24477	26112	12878	11145	105	5049	1024	5997	2698	1732	2748	1474</		

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	
	22 82	145807.	191305.	35810.	25798.	88186.	739.	71546.	9701.	23372.	1347.	953.	7852.	4401.	11109.	0.	30.	720.	1274.	30.
	23 62	18941.	130001.	10746.	111602.	153.	11437.	114392.	762.	17083.	4678.	9125.	1419.	1207.	517.	3.	63.	16052.	1128.	95.
Jhansi	23 70	15472.	157581.	8900.	111086.	637.	16900.	121181.	857.	17365.	7895.	9232.	1732.	952.	747.	0.	74.	17225.	803.	26.
	23 82	3938.	103066.	4052.	62622.	141.	5903.	90166.	1010.	18921.	23718.	6770.	3744.	124.	369.	0.	2636.	5601.	2894.	0.
	24 62	6414.	96495.	16872.	41607.	18636.	17.	136858.	7511.	19993.	764.	32.	21.	2526.	343.	193.	15.	914.	4633.	4.
Jalaun	24 70	9640.	111798.	11101.	29997.	21697.	31.	140082.	7531.	17040.	11099.	389.	15.	1685.	569.	0.	6.	658.	3868.	1.
	24 82	3410.	103215.	11567.	26153.	17017.	17.	91181.	2438.	15876.	67450.	1760.	95.	2203.	91.	15.	336.	15982.	1641.	127.
	25 62	6156.	127204.	6832.	92329.	2474.	10.	178757.	1715.	31021.	2126.	2606.	111.	2229.	104.	0.	13.	21863.	2256.	108.
Hamirpur	25 70	6634.	140856.	5508.	82967.	4139.	20.	199380.	2001.	28620.	4517.	2606.	111.	2229.	104.	0.	13.	21863.	2256.	108.
	25 82	3422.	153896.	6679.	83795.	1371.	0.	179038.	648.	27915.	19465.	5192.	582.	1388.	126.	0.	281.	8011.	8033.	96.
	26 62	90597.	113370.	16539.	77322.	13201.	390.	185570.	409.	30104.	6681.	275.	193.	186.	177.	0.	1.	5987.	1204.	112.
Banda	26 70	80779.	117380.	14793.	71773.	22093.	32.	200130.	439.	31183.	12343.	387.	57.	824.	276.	0.	2.	5384.	1212.	109.
	26 82	82836.	178153.	14925.	70326.	14439.	22.	172273.	411.	31399.	16192.	582.	245.	418.	364.	0.	50.	1422.	3163.	41.
	27 62	145608.	38176.	56653.	4375.	16828.	9272.	38306.	25433.	19529.	1628.	2757.	92.	18257.	3650.	0.	4.	112.	161.	12.
Varanasi	27 70	145147.	55445.	56364.	6065.	16662.	16167.	30593.	20294.	20694.	1439.	3270.	115.	18327.	5022.	0.	0.	207.	202.	0.
	27 82	150657.	148642.	11563.	4900.	17820.	12370.	23849.	6639.	17738.	4004.	4084.	1317.	13925.	6539.	0.	113.	312.	571.	0.
	28 62	133453.	46119.	51501.	7631.	13428.	12148.	49499.	5011.	20846.	4133.	4339.	341.	5521.	998.	3.	47.	6904.	2706.	16.
Mirzapur	28 70	128058.	54927.	42708.	8278.	13557.	17653.	37557.	4156.	22059.	3579.	4717.	30.	4095.	1776.	0.	1833.	6398.	2814.	4.
	28 82	157035.	109812.	33643.	7531.	13915.	15704.	37196.	2264.	22719.	4477.	3880.	392.	3893.	2975.	0.	1792.	4812.	3389.	0.
	29 62	98313.	27873.	87950.	6964.	8463.	40566.	13106.	22893.	11540.	43.	2246.	90.	18252.	4604.	0.	0.	0.	16.	135.
Jaunpur	29 70	88590.	43080.	94334.	6347.	9038.	61367.	9231.	18264.	11774.	65.	2486.	176.	17685.	6735.	0.	0.	30.	59.	176.
	29 82	104366.	149841.	9803.	5064.	10840.	58337.	64569.	4997.	11747.	109.	4309.	1774.	18453.	7558.	0.	0.	72.	857.	146.
	30 62	93303.	16403.	55141.	5059.	13693.	4246.	35522.	23952.	17491.	3515.	76.	100.	13181.	1735.	0.	24.	6.	236.	9.
Ghazipur	30 70	92488.	30853.	54568.	6655.	19573.	7462.	30425.	19204.	24649.	4815.	167.	214.	14785.	2369.	0.	20.	30.	187.	6.
	30 82	119739.	117336.	15149.	5344.	15651.	3526.	25384.	2654.	12750.	5075.	330.	3024.	16016.	5470.	0.	72.	40.	338.	0.
	31 62	70472.	21895.	51815.	2835.	5966.	21341.	39135.	18119.	18192.	4487.	24.	81.	16192.	2291.	0.	54.	7.	638.	64.
Ballia	31 70	74614.	33871.	45898.	2319.	5610.	24807.	35352.	16404.	15897.	3889.	41.	28.	18282.	2663.	0.	38.	4.	325.	27.
	31 82	106649.	108082.	14725.	3083.	4650.	14571.	28962.	1823.	12605.	4596.	11.	1207.	15304.	4989.	0.	107.	1.	466.	0.
	32 62	238888.	87469.	90992.	210.	391.	7076.	24287.	47577.	3032.	6760.	327.	110.	25190.	3321.	0.	2508.	720.	2759.	7.
Gorakhpur	32 70	249565.	153444.	53401.	87.	176.	11669.	15889.	30452.	8483.	5458.	282.	47.	25193.	4145.	0.	5167.	247.	3058.	0.
	32 82	301235.	277037.	12912.	208.	454.	7271.	17162.	9123.	8946.	8632.	179.	1098.	23939.	6491.	0.	6794.	321.	4817.	1.
	33 62	168644.	82054.	61112.	984.	1693.	22464.	11714.	41880.	7544.	7651.	86.	78.	80474.	2171.	0.	165.	185.	594.	19.
Deoria	33 70	184186.	155626.	45850.	712.	1486.	26654.	10636.	32031.	8358.	5059.	54.	113.	75409.	2926.	0.	287.	281.	590.	13.
	33 82	243178.	232915.	7462.	1017.	1292.	14945.	9523.	6032.	8546.	2912.	97.	1891.	74740.	4879.	0.	846.	384.	3202.	0.
	34 62	296762.	120462.	78854.	32.	85.	23413.	26135.	71762.	709.	3640.	1431.	308.	81987.	4071.	0.	286.	234.	3252.	9.
Basti	34 70	317018.	179838.	49688.	10.	22.	21363.	19569.	65133.	1223.	2006.	1009.	160.	31508.	4548.	0.	803.	169.	3596.	10.
	34 82	363200.	269339.	12934.	31.	62.	15424.	28306.	21238.	4575.	2506.	1173.	266.	32221.	6951.	0.	1398.	137.	6655.	29.
	35 62	195500.	22641.	107967.	686.	769.	17107.	22845.	56213.	22838.	449.	83.	95.	37648.	3055.	0.	56.	6.	170.	64.
Azamgarh	35 70	202931.	39557.	106438.	309.	718.	21906.	19071.	50377.	85525.	281.	72.	64.	37945.	4376.	0.	60.	0.	169.	26.
	35 82	232999.	213582.	23353.	262.	896.	17869.	24963.	11328.	22405.	223.	197.	3671.	41501.	6434.	0.	241.	48.	343.	4.
	36 62	62510.	45304.	2994.	703.	80.	24287.	20612.	557.	384.	7494.	1090.	23.	24069.	221.	296.	24.	40.	13501.	40.
Nainital	36 70	66100.	68923.	2222.	352.	989.	22083.	15933.	577.	436.	11726.	896.	11.	34244.	280.	0.	117.	13.	18080.	12.
	36 82	106093.	115812.	2431.	56.	27.	14745.	2974.	779.	486.	8169.	657.	308.	36987.	2270.	36.	42.	150.	10144.	6.
	37 62	35988.	41556.	14640.	10167.	7753.	5834.	24481.	6649.	9564.	181.	5168.	121.	2245.	2365.	0.	5994.	51.	102.	41.
Lucknow	37 70	39882.	52436.	10356.	10235.	9862.	9214.	18752.	4238.	10611.	74.	3745.	78.	3437.	3443.	0.	7695.	432.	49.	10.
	37 82	46203.	74125.	3593.	7534.	7248.	5095.	10793.	1869.	7437.	140.	4964.	240.	1639.	7225.	0.	2782.	283.	560.	0.
	38 62	54912.	77177.	59973.	14493.	8715.	26510.	34831.	14501.	12940.	181.	1363.	859.	7502.	1910.	1.	14205.	681.	431.	15.
Unnao	38 70	70649.	86978.	55649.	23086.	9310.	35308.	31585.	9879.	20739.	109.	2060.	1049.	6869.	2324.	0.	16169.	648.	1103.	46.
	38 82	84017.	148274.	23959.	17149.	5862.	30089.	18473.	2348.	14418.	157.	3677.	2577.	4004.	3880.	0.	11683.	457.	4483.	21.
Rae Bareli	39 62	94533.	54747.	50710.	27904.	10038.	419.	30335.	19334.	23527.	70.	12553.	576.	3014.	1436.	0.	4070.	901.	1041.	69.
	39 70	106205.	63399.	49584.	28402.	10872.	902.	23083.	15715.	24380.	65.	10975.	667.	2708.	1979.	0.	4497.	504.	1838.	61.
	39 82	115567.	128028.	13819.	20115.	6026.	478.	18140.	5731.	17321.	55.	9065.	2471.	4754.	3911.	0.	14443.	401.	3117.	16.
	40 62	102448.	114577.	47254.	6448.	8680.	29213.	71819.	9556.	4817.	3432.	21578.	134.	42148.	1370.	0.	24825.	89.	921.	650.
Sitapur	40 70	90142.	137357.	29362.	6388.	8180.	43802.	62397.	4880.	5614.	1360.	15649.	76.	35694.	1880.	0.	33668.	257.	1499.	508.
	40 82	129666.	182158.	17774.	10245.	6579.	20252.	30736.	1763.	11185.	3829.	15578.	131.	43532.	3307.	0.	12982.	149.	4477.	419.
	41 62	50403.	96773.	50220.	26770.	15179.	23822.	65479.	28268.	33125.	2554.	14401.	372.	22915.	3698.	0.	38015.	14.	1355.	137.
Hardoi	41 70	57012.	120908.	40355.	25263.	10138.	45945.	62681.	13321.	19897.	1291.	8673.	285.	19092.	4322.	0.	56440.	14.	2100.	55.
	41 82	79807.	226698.	20328.	19703.	10782.	39983.	34663.	2503.	12045.	1455.	16207.	758.	194						

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Gonda	44 70	242786.	152216.	27288.	1136.	1249.	102983.	45716.	50699.	3811.	14955.	3308.	38.	25623.	2969.	0.	327.	144.	8608.	23.
	44 82	275351.	237614.	8514.	541.	316.	82363.	46594.	5180.	8407.	15928.	3147.	219.	28905.	4335.	0.	348.	184.	15344.	390.
Bahraich	45 62	142228.	118543.	39381.	1255.	1200.	134017.	45684.	5595.	1803.	24622.	4848.	119.	5480.	1339.	0.	3762.	1060.	11338.	76.
	45 70	155997.	136471.	28434.	780.	807.	153966.	38139.	2256.	1632.	17327.	2920.	114.	5289.	1198.	0.	6592.	857.	14377.	33.
Sultanpur	45 82	226998.	193872.	9141.	1042.	428.	115349.	32878.	500.	6117.	31924.	4863.	101.	6191.	2173.	0.	9336.	661.	14080.	12.
	46 62	112957.	45328.	37940.	14667.	3178.	4633.	49066.	29623.	14185.	1414.	5205.	222.	9836.	2375.	0.	33.	6.	135.	33.
Pratapgarh	46 70	135774.	54485.	38058.	14923.	2467.	6466.	35848.	24146.	14939.	1103.	4536.	288.	9117.	3746.	0.	43.	35.	175.	18.
	46 82	144785.	116667.	14658.	13023.	1635.	6030.	32375.	8431.	13341.	1708.	3998.	3138.	8164.	5174.	0.	12.	96.	799.	0.
Barabanki	47 62	67954.	29120.	52978.	9475.	20252.	2320.	22632.	18331.	24101.	18.	3563.	354.	4295.	1815.	0.	6.	79.	301.	51.
	47 70	84210.	29913.	51253.	9593.	20572.	2701.	18960.	18100.	24534.	13.	4151.	559.	4244.	3169.	0.	17.	150.	346.	48.
Almora	47 82	91666.	107898.	14824.	6206.	16240.	2993.	14467.	4633.	17751.	43.	3892.	4563.	3113.	5832.	0.	21.	171.	707.	23.
	48 62	118616.	72567.	19879.	6890.	4113.	10115.	83325.	9208.	5463.	688.	14838.	86.	20766.	2454.	0.	2349.	39.	436.	230.
Pithoragarh	48 70	124334.	92159.	14750.	7453.	5180.	13381.	66708.	7206.	5742.	526.	11858.	169.	19830.	4491.	0.	3734.	98.	694.	191.
	48 82	154079.	154651.	5097.	7242.	2703.	8901.	30482.	2682.	8020.	1549.	11040.	386.	15730.	10354.	0.	3134.	105.	1975.	217.
Tehrigarhwal	49 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	49 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Uttar Kashi	49 82	36300.	64105.	9312.	0.	0.	3017.	11.	20.	27.	1502.	413.	0.	0.	515.	0.	2.	104.	155.	21.
	50 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Garhwal	50 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	50 82	32914.	44904.	7938.	0.	0.	5049.	77.	41.	21.	5040.	563.	0.	192.	930.	0.	18.	32.	47.	72.
Chamoli	51 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	51 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Lalitpur	51 82	17283.	41522.	5404.	0.	0.	1575.	5.	25.	430.	377.	935.	0.	0.	559.	0.	0.	569.	194.	37.
	52 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Ghaziasad	52 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	52 82	10136.	15969.	846.	0.	0.	392.	4.	15.	25.	370.	264.	0.	0.	631.	0.	0.	504.	192.	53.
Bahraich	53 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	53 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Sultanpur	53 82	27341.	44216.	9571.	0.	0.	2539.	75.	12.	192.	126.	897.	0.	7.	129.	0.	1.	197.	549.	14.
	54 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Pratapgarh	54 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	54 82	19895.	25023.	2628.	0.	0.	292.	0.	3.	20.	53.	137.	0.	0.	645.	0.	1.	28.	112.	31.
Bahraich	55 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	55 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Ghaziasad	55 82	8168.	110321.	3892.	1807.	18110.	37778.	3259.	5419.	996.	1095.	367.	1443.	52603.	5222.	1468.	1.	11.	1438.	0.
	56 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Lalitpur	56 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	56 82	11687.	75153.	4298.	50264.	25.	16794.	28259.	161.	243.	4879.	12164.	3479.	475.	299.	0.	147.	3253.	787.	1.

SOURCE : Season and crop reports (yearly), Revenue Board, Government of Uttar Pradesh, Lucknow

Appendix III

Districtwise Trinnium Averages of production of Nineteen Crops in Uttar Pradesh

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
Dehra Dun	1 70	13145	22067	2159	0	11027	647	247	156	446	617	0	267104	4277	13	60	52	407	63
	1 82	10508	34255	2798	0	17725	747	285	71	507	551	0	278532	15237	0	159	58	442	43
Saharanpur	2 62	99906	93953	3026	161	5044	18500	25358	5358	364	2430	527	8	3316488	4729	3998	5113	40	101
	2 70	102629	186469	2037	37	4825	13955	12957	3158	229	1387	510	14	4204370	30119	3329	6724	139	371
	2 82	144790	345617	1505	105	504	28462	1611	1050	161	4009	362	248	6520623	5119	3555	9	1	14
Muzaffarnagar	3 62	30594	129079	1213	5422	1838	12471	26341	1097	415	1039	222	60	4922940	5119	3555	9	1	14
	3 70	42497	212782	538	125	1064	24034	12273	1097	285	1487	175	190	9177735	39274	4125	495	0	74
	3 82	60500	380483	384	20	241	16173	1385	1097	285	1487	175	20	5827599	19328	7718	122	0	193
Meerut	4 62	17305	185722	209	2716	8842	26006	36143	36379	3187	1162	260	48	6481997	43571	9510	19	1	140
	4 70	21342	341353	1436	336	5406	83562	14190	39799	2161	1397	139	728	8041740	9747	1020	5	0	592
	4 82	20906	404466	349	90	1956	42466	12577	2395	624	1107	225	19	2553688	9975	10211	172	7	377
Bulandshahr	5 62	5324	139158	57814	2349	11576	27505	21856	55334	6572	743	105	58	1708731	36953	7613	87	4	531
	5 70	9656	314793	28106	2493	16656	134621	11551	34157	5786	893	194	58	1708731	36953	7613	87	4	531
	5 82	7164	527605	33622	919	18183	161320	4957	5841	4236	1597	495	18123	2943382	145972	1615	12	22	3238
Aligarh	6 62	7804	115180	52038	661	43459	19298	33901	67856	17365	493	274	38	834717	39958	7551	813	8	596
	6 70	12171	345029	59108	1076	95836	79397	30366	50999	9276	573	213	39	627168	23843	9566	1011	3	578
	6 82	15991	518216	90777	608	82230	56725	17917	31470	8219	1460	379	13088	657607	81157	4900	240	15	13414
Mathura	7 62	432	96174	45175	1139	12220	1519	1047	1838	10127	100	293	37	544699	7513	3505	89	70	1124
	7 70	3825	206652	48840	2778	35837	7684	14477	22998	11538	541	335	1240	596127	41773	1691	8	103	10177
	7 82	3378	367947	54681	900	44235	2459	13015	6872	3898	573	353	1240	596127	41773	1691	8	103	10177
Agra	8 62	822	92125	38176	2070	38922	294	86186	11563	29116	48	312	30	214484	16445	900	466	74	12408
	8 70	1872	178634	23373	2003	68520	3882	63480	13802	32727	85	369	30	214484	16445	900	466	74	12408
	8 82	1657	294325	40100	567	97297	940	30610	8957	19383	143	390	30	214484	16445	900	466	74	12408
Mainpuri	9 62	50523	72951	24641	1738	15907	15847	30454	25671	19968	1	146	10	178910	56554	20	7230	20	2267
	9 70	37699	166931	20015	3528	39877	62183	29154	21811	14859	1	146	10	178910	56554	20	7230	20	2267
	9 82	56265	310470	22804	889	34924	20755	14570	4869	7654	1	146	10	178910	56554	20	7230	20	2267
Etah	10 62	17997	96835	23328	624	34526	26474	32129	15303	13280	194	30	10	345109	15895	1004	13784	10	631
	10 70	17754	181370	19293	1708	67340	64478	37419	35025	14210	1	40	10	345109	15895	1004	13784	10	631
	10 82	23410	313714	20801	1182	70006	37410	13014	22826	8557	1	224	1090	332944	110750	191	3153	50	1011
Bareilly	11 62	78854	66325	2795	8418	6793	9078	27715	7143	4583	401	296	24	1652959	1028	10	13174	10	101
	11 70	78631	117667	2329	10699	9971	15379	24509	1031	3027	447	411	24	1621366	17330	5	15511	10	101
	11 82	150104	26204	1745	21788	9859	4435	19170	1686	11555	581	1024	46	1976597	78322	7	20608	10	101
Bijnor	12 62	63019	79922	3450	218	5275	2544	1410	1619	707	79	1574	148	2882610	3133	492	4201	10	101
	12 70	73101	131205	2477	165	2287	7196	17883	1524	1078	148	2574	109	1142360	7540	301	8497	10	101
	12 82	106688	206754	2010	99	531	3344	3131	296	3477	172	855	496	1412931	13497	378	7297	105	1071
Budaun	13 62	23999	101472	10051	4584	30430	10112	25094	15495	9600	109	232	25	574851	15252	406	29097	10	101
	13 70	27521	168556	5756	5319	51978	38444	24968	19250	19176	128	395	10	844421	33383	101	27098	10	101
	13 82	42298	359424	7204	5500	70059	28647	22467	3391	12596	2614	3511	305	842593	11172	153	44441	10	101
Moradabad	14 62	43570	127686	9803	6270	19686	10754	20255	11861	8453	49	1795	73	2780251	14880	219	16113	10	101
	14 70	55961	263300	6730	5415	27120	34680	16214	19309	10468	674	1141	82	5306728	98894	233	6304	89	1507
	14 82	135387	495527	4313	8635	22112	13769	5123	2237	3552	134	847	804	999531	14999	0	3556	159	218
Shahjahanpur	15 62	79010	62163	10356	3087	4707	3553	10288	8974	5722	4354	2140	342	2238210	28488	0	8105	115	1525
	15 70	67502	125220	9052	5107	12515	8535	26583	11055	10076	2760	2859	324	1426748	67081	44	4234	145	3706
	15 82	169450	334220	5018	4599	8446	2771	19196	1571	12537	3085	3448	164	1257387	5208	0	182	61	426
Pilibhit	16 62	71796	32262	2368	1447	1436	3109	9228	1268	1707	3213	1247	45	1467830	7138	0	1170	69	130
	16 70	75629	89232	2469	1852	1630	4639	16166	1467	2522	3505	1150	133	1481280	19131	28	620	256	1529
	16 82	226777	213222	1049	1373	325	2076	3422	307	3678	3298	735	6	933476	5914	16	731	0	932
Rampur	17 62	35423	48913	1332	13327	1460	27215	13766	930	2549	1775	50	7	835901	11210	4	1062	0	1638
	17 70	42385	120820	1317	12763	1803	30706	18280	1594	4587	2375	59	33	1162986	46374	5	793	18	275
	17 82	135099	214681	468	17760	2745	16072	4057	271	6260	1825	116	30	390349	73790	116	20505	3	1966
Farrukhabad	18 62	26779	74909	20237	8779	7356	50977	19037	15829	11475	130	136	29	271091	20317	9	13754	4	2179
	18 70	19113	133641	16273	2407	11075	95286	19067	9603	10689	129	205	2029	363763	121345	0	1466	94	6129
	18 82	31287	229546	9256	6727	8865	56638	18991	1787	9574	219	664	17	207583	11066	451	75	1	101
Etawah	19 62	54768	61439	27747	3291	27945	13440	30171	36613	20083	2	117	20	242148	4111	21	152	0	147
	19 70	50716	141334	17998	5174	67552	31344	30934	24556	26564	4	383	741	214397	165046	13	137	0	147
	19 82	81871	137923	27558	1804	38912	13116	30182	16442	23161	52	1488	20	275965	11113	107	3019	11	1130
Kanpur	20 62	67009	101328	56314	29734	13008	14590	57587	22137	32648	91	406	39	206201	49174	279	2062	160	15426
	20 70	57401	147708	51880	38389	27099	29535	74078	15004	41592	428	1072	325	267505	114387	218	1289	201	23312
	20 82	95359	375449	45872	25708	16178	17486	66023	13071	35049	396	2965	50	254464	11051	39	47	256</	

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
Gonda	44 70	156566.	147626.	16074.	998.	983.	69020.	36469.	23367.	4004.	7706.	1111.	11.	1074716.	27055.	0.	174.	18.	3136.	22.
	44 82	211656.	325997.	5883.	299.	245.	34826.	29362.	3027.	8919.	8247.	563.	113.	1200851.	48331.	0.	265.	20.	5833.	370.
Bahraich	45 62	82709.	65691.	20132.	905.	953.	90512.	15720.	2721.	833.	7997.	1670.	39.	160994.	6515.	0.	2792.	224.	3278.	59.
	45 70	100427.	124048.	23495.	700.	631.	114175.	29517.	1768.	1732.	9254.	992.	35.	210581.	10870.	0.	3485.	108.	5487.	31.
Sultanpur	45 82	126039.	245814.	6491.	580.	322.	36426.	13894.	346.	6561.	14794.	911.	31.	256011.	24289.	0.	7078.	71.	4119.	11.
	46 62	103195.	40046.	38761.	8143.	2437.	1641.	27723.	25124.	15541.	541.	1435.	68.	337287.	15981.	0.	22.	0.	37.	24.
Pratapgarh	46 70	90863.	53981.	39391.	7635.	1958.	4810.	26186.	19718.	17982.	686.	1607.	86.	325282.	34078.	0.	23.	5.	64.	17.
	46 82	138128.	173010.	18128.	7283.	1361.	2250.	24873.	5591.	18991.	843.	809.	1761.	294222.	57479.	0.	9.	10.	268.	0.
Barabanki	47 62	55189.	26744.	50872.	6486.	20518.	1031.	12940.	14213.	21310.	8.	1079.	121.	142969.	11141.	0.	4.	21.	83.	38.
	47 70	50721.	34060.	48295.	6203.	17093.	2008.	15149.	17330.	30798.	8.	1342.	169.	161631.	28716.	0.	9.	23.	125.	48.
Almora	47 82	107773.	156763.	16068.	3493.	13487.	1127.	11333.	4004.	19844.	20.	800.	2314.	114121.	76367.	0.	16.	17.	236.	24.
	48 62	109418.	68189.	14132.	5101.	3509.	5794.	60988.	8544.	8163.	254.	5538.	32.	674383.	14658.	0.	1774.	7.	137.	166.
Pithoragarh	48 70	106582.	101708.	12828.	6497.	4043.	9941.	58189.	5990.	7085.	327.	5788.	49.	800462.	40786.	0.	1986.	14.	250.	193.
	48 82	192742.	251145.	5747.	4660.	2195.	2733.	20430.	1314.	7585.	740.	2550.	258.	627546.	141689.	0.	2153.	10.	662.	254.
Tehrigarhwal	49 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	49 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Uttar Kashi	49 82	36642.	73962.	10244.	0.	0.	2809.	7.	18.	19.	1194.	208.	0.	0.	14177.	0.	1.	15.	78.	23.
	50 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Garhwal	50 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	50 82	31606.	54857.	10088.	0.	0.	5966.	46.	37.	14.	3756.	284.	0.	5080.	14410.	0.	14.	6.	23.	45.
Chamoli	51 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	51 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Lalitpur	51 82	20742.	43539.	5768.	0.	0.	1929.	3.	22.	370.	164.	365.	0.	0.	8661.	0.	0.	0.	0.	0.
	52 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Ghaziabad	52 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	52 82	14010.	17690.	1104.	0.	0.	458.	2.	12.	22.	173.	103.	0.	0.	9770.	0.	1.	82.	78.	15.
Bahraich	53 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	53 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Gonda	53 82	26978.	45639.	8240.	0.	0.	2086.	41.	8.	165.	55.	418.	0.	185.	1999.	0.	0.	0.	224.	5.
	54 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Sultanpur	54 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	54 82	23659.	25377.	2957.	0.	0.	282.	0.	2.	23.	23.	64.	0.	0.	9993.	0.	1.	5.	48.	20.
Pratapgarh	55 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	55 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Almora	55 82	8536.	258809.	4768.	284.	11456.	62705.	1988.	6354.	614.	642.	151.	695.	2654129.	102916.	907.	4.	0.	462.	0.
	56 62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Bahraich	56 70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	56 82	3538.	79784.	3634.	26403.	12.	11136.	19447.	163.	323.	2116.	2084.	752.	15259.	4994.	0.	103.	271.	343.	1.

SOURCE : Season and crop reports (yearly), Revenue Board, Government of Uttar Pradesh, Lucknow

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	
	22 82	176266.	295160.	49566.	21497.	39906.	492.	63113.	9095.	62547.	645.	163.	4269.	172152.	167217.	0.	27.	98.	649.	36.
	23 62	12283.	126662.	9404.	55836.	125.	6727.	76306.	553.	0.	1846.	283.	537.	35316.	3227.	2.	40.	2116.	398.	62.
Jhansi	23 70	6675.	162207.	6973.	64902.	258.	17838.	76824.	772.	11340.	5196.	3072.	551.	26425.	6830.	0.	51.	2979.	269.	25.
	23 82	2217.	134612.	3890.	39706.	56.	3929.	65477.	982.	16633.	16715.	1798.	594.	3951.	6177.	0.	1892.	557.	1337.	2.
	24 62	3293.	100836.	13768.	19619.	5540.	10.	88221.	5092.	0.	415.	13.	6.	73505.	2226.	111.	10.	74.	1748.	3.
Jalaun	24 70	3937.	114129.	9985.	12845.	7780.	34.	82773.	6247.	19065.	10102.	160.	5.	46681.	5197.	0.	4.	62.	1619.	32.
	24 82	1895.	159267.	14855.	16688.	7032.	10.	78693.	2432.	25134.	53181.	1761.	30.	44624.	10124.	0.	65.	12.	3089.	0.
Hamirpur	25 62	3958.	124657.	6080.	59512.	1540.	19.	101784.	1328.	18175.	793.	650.	29.	51684.	453.	8.	129.	2987.	572.	99.
	25 70	2793.	140693.	4075.	51425.	1682.	18.	113698.	1849.	24683.	3817.	897.	36.	61531.	964.	0.	9.	4239.	695.	103.
	25 82	1908.	194992.	6765.	48827.	604.	0.	129967.	649.	37127.	10448.	603.	52.	45644.	2127.	0.	211.	493.	3435.	129.
	26 62	80771.	106235.	13825.	44015.	7388.	175.	102990.	281.	23699.	2074.	129.	56.	5733.	884.	0.	2.	400.	367.	91.
Banda	26 70	61225.	120387.	9854.	34439.	9915.	34.	113050.	421.	39727.	5882.	138.	22.	22898.	2516.	0.	1.	730.	370.	105.
	26 82	56330.	192944.	13228.	47133.	6700.	13.	127936.	396.	40650.	10743.	155.	26.	13836.	6169.	0.	38.	127.	1338.	33.
	27 62	132754.	29684.	56664.	3549.	18728.	4953.	25078.	21678.	22293.	626.	920.	36.	626123.	21745.	0.	2.	27.	56.	9.
Varanasi	27 70	96408.	70603.	56550.	4906.	19744.	14469.	26016.	18024.	23455.	898.	1376.	42.	734400.	45443.	0.	0.	27.	86.	0.
	27 82	201880.	217266.	13416.	5229.	15368.	9221.	19389.	5743.	18873.	1710.	1401.	354.	546646.	121770.	0.	85.	26.	270.	0.
	28 62	106933.	27683.	46240.	5885.	15981.	10113.	29814.	4014.	13100.	1463.	1580.	80.	197397.	6171.	6.	31.	1450.	913.	11.
Mirzapur	28 70	76087.	59331.	38376.	4775.	12938.	13036.	32699.	3884.	23345.	2131.	1815.	10.	192033.	16109.	0.	22.	834.	1188.	4.
	28 82	144577.	109980.	28339.	8076.	13377.	13496.	36223.	1862.	18819.	1766.	1372.	101.	130222.	41660.	0.	1376.	404.	1575.	0.
	29 62	80834.	23938.	90128.	2727.	5030.	33033.	6793.	20268.	13883.	17.	919.	39.	815293.	34428.	0.	0.	0.	5.	96.
Jaunpur	29 70	47102.	54477.	83503.	5193.	8664.	91751.	7678.	17569.	14675.	40.	1613.	67.	704973.	60978.	0.	2.	3.	25.	169.
	29 82	118187.	274363.	12432.	5418.	5236.	57037.	12722.	4149.	13630.	71.	1326.	765.	816446.	155577.	0.	0.	6.	168.	97.
	30 62	68257.	14468.	57932.	5000.	19574.	3068.	24752.	22095.	18239.	1315.	34.	46.	471509.	13207.	0.	15.	1.	84.	8.
Ghazipur	30 70	244873.	41626.	56044.	5392.	20528.	5698.	26682.	16862.	20743.	3654.	96.	81.	702666.	21563.	0.	14.	4.	79.	6.
	30 82	109486.	186483.	19167.	5865.	13536.	3004.	27313.	2154.	10125.	4747.	114.	1433.	558835.	94210.	0.	54.	2.	158.	0.
	31 62	40043.	24400.	51125.	2029.	2761.	17256.	32065.	16967.	12217.	1623.	9.	29.	604870.	14277.	0.	31.	1.	203.	33.
Ballia	31 70	48607.	43327.	51340.	1861.	5391.	18052.	34284.	13029.	12779.	3071.	30.	11.	906461.	24195.	0.	27.	0.	140.	2.
	31 82	50147.	174572.	17056.	3706.	3199.	6888.	38118.	1468.	10525.	3793.	3.	593.	565528.	76077.	0.	81.	0.	216.	1.
	32 62	187712.	71349.	63379.	144.	392.	5475.	13786.	36607.	1813.	2442.	114.	35.	1101713.	17794.	0.	1842.	148.	915.	6.
Gorakhpur	32 70	209107.	187393.	41482.	62.	183.	9185.	11322.	27047.	2780.	2684.	132.	17.	1300114.	37615.	0.	3319.	42.	1304.	9.
	32 82	313855.	442990.	12703.	216.	337.	2822.	12516.	5331.	6237.	5244.	64.	515.	1155913.	68271.	0.	5143.	32.	2369.	2.
	33 62	112595.	88505.	47104.	624.	1790.	16596.	5832.	28735.	4211.	2973.	31.	29.	3112877.	12853.	0.	113.	107.	306.	18.
Deoria	33 70	129496.	27111.	37379.	537.	1499.	21995.	7440.	27325.	6797.	2663.	25.	48.	3211854.	26288.	0.	204.	49.	907.	16.
	33 82	298101.	381039.	8532.	1085.	1076.	9768.	8035.	3989.	6513.	1764.	29.	900.	3318154.	58031.	0.	637.	34.	2042.	0.
Basti	34 62	226131.	92147.	34229.	27.	94.	12949.	12792.	49279.	432.	1166.	504.	104.	1315336.	24887.	0.	236.	68.	1118.	3.
	34 70	226721.	217940.	49963.	6.	23.	15325.	16633.	59979.	976.	1231.	471.	62.	1418212.	41233.	0.	572.	29.	1671.	10.
	34 82	281690.	368898.	9773.	32.	51.	6992.	19847.	12931.	3550.	1144.	388.	95.	1375230.	60490.	0.	1053.	13.	3391.	26.
	35 62	125288.	18820.	86726.	480.	858.	12475.	12470.	57580.	11079.	161.	29.	38.	1621438.	15433.	0.	40.	1.	59.	42.
Azamgarh	35 70	122307.	48213.	109434.	228.	751.	17288.	15394.	45115.	22097.	169.	33.	26.	1419601.	39652.	0.	42.	0.	73.	25.
	35 82	198336.	337576.	30188.	277.	739.	13837.	19274.	7943.	15639.	107.	62.	1784.	1518276.	91098.	0.	183.	4.	176.	3.
	36 62	64699.	38571.	1874.	226.	28.	21892.	9519.	323.	198.	4188.	352.	6.	1087671.	1394.	146.	22.	8.	6731.	28.
Nainital	36 70	82729.	91219.	1551.	175.	436.	26155.	10637.	539.	461.	7166.	361.	4.	1400225.	2542.	29.	83.	2.	10710.	11.
	36 82	243483.	228423.	2922.	44.	20.	21680.	1815.	740.	695.	2843.	306.	146.	1744256.	34480.	0.	30.	18.	5825.	3.
	37 62	24524.	39825.	12519.	5235.	2760.	4585.	21498.	4696.	6347.	41.	1731.	49.	71768.	10247.	0.	5044.	11.	32.	31.
Lucknow	37 70	29129.	57256.	8037.	13674.	6503.	9131.	18385.	3914.	9884.	37.	741.	24.	146631.	31609.	0.	6296.	67.	22.	10.
	37 82	48055.	124952.	3559.	6328.	3717.	1234.	8584.	1574.	9431.	69.	1254.	69.	63351.	120721.	0.	2216.	21.	247.	0.
	38 62	50461.	32160.	48640.	17835.	3101.	15444.	17834.	9772.	16234.	52.	580.	111.	208651.	11594.	0.	15081.	122.	175.	54.
Unnao	38 70	64867.	91538.	48764.	17718.	5987.	29344.	21751.	9443.	21203.	54.	617.	314.	269857.	21128.	0.	13194.	83.	545.	43.
	38 82	91360.	235542.	26168.	13225.	2639.	10881.	16550.	1990.	14954.	77.	733.	746.	194988.	57798.	0.	6968.	46.	2032.	36.
	39 62	81462.	46518.	38600.	25376.	3508.	362.	21918.	15339.	22452.	36.	3816.	193.	84507.	9837.	0.	3490.	164.	290.	51.
Rae Bareli	39 70	71414.	74977.	46995.	27225.	7162.	985.	19482.	14336.	28473.	32.	3224.	199.	106200.	17993.	0.	3688.	117.	440.	59.
	39 82	137070.	177175.	24667.	17030.	2670.	242.	14393.	4921.	24724.	27.	3523.	965.	512137.	58251.	0.	3004.	42.	1406.	14.
	40 62	66114.	84914.	28833.	3615.	2882.	9233.	39436.	5732.	3229.	1175.	5990.	39.	1449760.	7321.	0.	25198.	16.	272.	509.
Sitapur	40 70	58817.	136948.	29429.	5372.	5377.	23738.	59932.	5239.	5459.	551.	6020.	22.	1327131.	17026.	0.	26132.	17.	632.	468.
	40 82	99850.	279725.	19619.	9057.	2973.	6933.	23640.	1493.	8707.	1528.	6146.	35.	1768753.	48884.	0.	11664.	14.	1972.	500.
	41 62	42544.	74263.	36023.	11170.	3007.	13510.	32814.	17456.	9764.	1068.	3620.	101.	750611.	25200.	0.	42820.	4.	365.	108.
Hardoi	41 70	44655.	154293.	38375.	20675.	6023.	49245.	50936.	12335.	19604.	669.	3544.	86.	742974.	39195.	0.	48374.	2.	892.	51.
	41 82	74438.	385034.	20676.	17743.	3915.	19084.	29467.	1871.	14171.	674.	4698.	279.	772463.	104830.	0.	25029.	2.	4237.	92.

Appendix IV

DISTRICTWISE TRIENNIAL AVERAGE YIELD OF MAJOR CROPS

(kilograms per hectare)

Sl. No.	Districts	Rice			Wheat		
		1960-63	1968-71	1980-83	1960-63	1968-71	1980-83
1.	Dehra Dun	1020	1030	1120	860	970	1270
2.	Saharanpur	1010	1160	1550	780	1200	1880
3.	Muzaffarnagar	910	980	1530	1190	1490	2340
4.	Meerut	970	1010	1330	1150	1570	2430
5.	Bulandshahr	940	820	740	1320	1700	2490
6.	Aligarh	850	750	1050	1130	1930	2430
7.	Mathura	830	750	1120	1200	1520	2180
8.	Agra	790	730	1080	1250	1510	2220
9.	Mainpuri	980	770	980	1060	1510	1940
10.	Etah	910	750	920	1120	1470	1990
11.	Bareilly	830	780	1290	760	1070	1700
12.	Bijnor	770	770	1310	950	1260	1630
13.	Budaun	860	820	1040	740	1100	1780
14.	Moradabad	620	750	1320	770	1270	1930
15.	Shahajahanpur	990	830	1350	720	1090	1790
16.	Pilibhit	840	840	1860	610	1210	1750
17.	Rampur	760	810	1830	920	1580	2170
18.	Farrukhabad	1020	790	1000	950	1260	1750
19.	Etawah	1100	900	1200	1110	1530	2460
20.	Kanpur	1070	880	1240	1060	1320	2180
21.	Fatehpur	890	740	1170	890	1140	1740
22.	Allahabad	740	620	1060	810	850	1540
23.	Jhansi	650	430	560	970	1030	1310
24.	Jalaun	510	410	560	1040	1020	1540
25.	Hamirpur	640	420	560	980	1000	1270
26.	Banda	890	760	680	940	1030	1080
27.	Varanasi	910	660	1340	780	1270	1460
28.	Mirzapur	800	590	920	600	1080	1000
29.	Jaunpur	820	530	1130	860	1260	1830
30.	Ghazipur	730	820	910	880	1350	1590



(Appendix IV contd...)

(kilograms per hectare)

Sl. No.	Districts	Rice			Wheat		
		1960-63	1968-71	1980-83	1960-63	1968-71	1980-83
31.	Ballia	570	650	840	1110	1280	1620
32.	Gorakhpur	800	840	1040	820	1220	1600
33.	Deoria	670	700	1230	830	1030	1640
34.	Basti	770	720	780	760	1210	1370
35.	Azamgarh	640	600	850	830	1220	1580
36.	Nainital	1040	1250	1290	850	1320	1970
37.	Lucknow	680	750	1040	960	1090	1690
38.	Unnao	930	920	1090	890	1050	1590
39.	Rae Bareli	860	670	1190	850	1180	1380
40.	Sitapur	650	650	770	740	1000	1540
41.	Hardoi	840	780	930	770	1280	1700
42.	Kheri	690	580	1110	670	830	1380
43.	Faizabad	800	690	1200	960	1060	1840
44.	Gonda	730	640	770	650	970	1370
45.	Bahraich	580	640	560	550	910	1270
46.	Sultanpur	910	670	950	880	990	1480
47.	Pratapgarh	810	600	1180	920	1160	1450
48.	Barabanki	920	860	1250	940	1100	1620
49.	Almore	0000	0000	1010	000	000	1150
50.	Pithoragarh	0000	0000	960	000	000	1220
51.	Tehrigarhwal	000	000	1200	000	000	1050
52.	Uttar Kashi	000	000	1380	000	000	1110
53.	Garhwal	000	000	990	000	000	1030
54.	Chamoli	000	000	1190	000	000	1010
55.	Ghaziabad	000	000	1040	000	000	2350
56.	Lalitpur	000	000	300	000	000	1060

(Appendix IV contd...)

Sl. No.	Districts	(kilograms per hectare)								
		Barley			Maize			Sugarcane		
		1960-63	1968-71	1980-83	1960-63	1968-71	1980-83	1960-63	1968-71	1980-83
31.	Ballia	990	1120	1160	810	730	470	37360	48010	36950
32.	Gorakhpur	700	780	980	770	790	390	43740	45610	48290
33.	Deoria	770	820	1140	740	830	650	38680	42590	44400
34.	Basti	430	1010	760	550	720	450	41120	45010	42680
35.	Azamgarh	800	1030	1290	730	790	770	43070	37410	36580
36.	Nainital	630	700	1200	900	1180	1470	45190	40890	47160
37.	Lucknow	860	780	990	790	990	940	31980	42660	38650
38.	Unnao	820	880	1090	580	830	860	27810	39280	48700
39.	Rae Bareilly	760	950	1310	910	1090	510	28040	39220	47720
40.	Sitapur	610	1000	1100	320	340	340	34400	37180	40630
41.	Hardoi	720	950	1020	570	1090	480	32760	38910	39780
42.	Kheri	550	750	830	630	620	650	32730	35200	39050
43.	Faizabad	950	800	1410	680	750	850	43970	39470	44250
44.	Gonda	460	590	690	690	670	420	31100	41940	41540
45.	Bahraich	510	830	710	680	740	820	29380	39820	41350
46.	Sultanpur	1020	1040	1240	350	760	370	34290	35680	36040
47.	Pratapgarh	960	940	1080	440	740	380	33290	38090	36660
48.	Barabanki	710	870	1130	570	740	310	32470	40370	39890
49.	Almora	000	000	1100	-	-	930	-	-	-
50.	Pithoragarh	000	000	1270	-	-	1180	-	-	26460
51.	Tehri Garhwal	000	000	1070	-	-	1220	-	-	-
52.	Uttar Kashi	000	000	1300	-	-	1170	-	-	-
53.	Garhwal	000	000	860	-	-	820	-	-	26430
54.	Chamoli	000	000	1130	-	-	970	-	-	00
55.	Ghaziabad	000	000	1230	-	-	1660	-	-	50460
56.	Lalitpur	000	000	850	-	-	660	-	-	32120

Source: Season and Crop Reports (Yearly) Revenue Board, Government of Uttar Pradesh, Lucknow.

(Appendix IV contd...)

Sl. No.	Districts	(kilograms per hectare)								
		Barley			Maize			Sugarcane		
		1960-63	1968-71	1980-83	1960-63	1968-71	1980-83	1960-63	1968-71	1980-83
1.	Dehra Dun	1040	760	1300	1110	920	1380	38430	45940	50530
2.	Saharanpur	720	810	1280	600	780	960	42550	47640	50450
3.	Muzaffarnagar	770	890	1310	600	1000	1000	47310	49630	50500
4.	Meerut	680	840	1270	540	1230	1410	42260	45870	50470
5.	Bulandshahr	990	910	1480	450	1300	1460	32670	36890	48020
6.	Aligarh	970	1350	1810	450	1070	1010	27490	31210	42190
7.	Mathura	1170	1320	1480	240	810	550	37760	32940	34290
8.	Agra	1040	1080	1580	260	790	660	33390	43390	39560
9.	Mainpuri	910	1260	1410	530	730	510	35470	44830	39770
10.	Etah	870	1140	1480	650	1090	790	22280	36170	42230
11.	Bareilly	570	760	1330	770	900	550	42420	41500	42320
12.	Bijnor	590	490	820	820	890	910	44080	43440	48480
13.	Budaun	530	600	850	430	890	770	24050	36970	42300
14.	Moradabad	500	790	900	760	900	630	42480	46140	50040
15.	Shahajahanpur	590	800	1020	730	890	470	30640	38890	47000
16.	Pilibhit	580	690	900	660	880	810	38010	39540	43560
17.	Rampur	590	690	840	910	980	920	33070	42460	44530
18.	Farrukhabad	890	1110	1010	1150	1300	730	33170	34300	40090
19.	Etawah	1140	1010	1670	610	980	540	40030	34230	39000
20.	Kanpur	1030	1160	1630	570	950	580	39440	34370	39100
21.	Fatehpur	740	820	1200	1520	1120	720	40690	34430	41030
22.	Allahabad	1000	940	1380	830	1140	670	40290	34490	39120
23.	Jhansi	880	780	960	590	1060	670	29250	27770	31770
24.	Jalaun	820	900	1280	560	1070	600	29100	27700	32200
25.	Hamirpur	890	740	1010	1090	900	500	23460	27610	32870
26.	Banda	840	670	890	450	1040	610	30840	27800	33130
27.	Varanasi	1000	1000	1160	530	890	750	34290	40070	39260
28.	Mirzapur	900	900	840	830	740	860	35760	46900	33450
29.	Jaunpur	1020	990	1270	810	1500	980	44670	39860	44250
30.	Ghazipur	1050	1030	1270	720	760	850	35770	47520	34890

Appendix V

DISTRICTWISE TRINNIUM AVERAGES OF AREA
AND PRODUCTIVITY IN U.P.

Sl. No.	Districts	1960-63		1968-71		1980-83	
		Trinium Average of NSA in Hect.	Agricultural productivity in Rs.	Trinium Average of NSA in Hect.	Agricultural productivity in Rs.	Trinium Average of NSA in Hect.	Agricultural productivity in Rs.
1	2	3	4	5	6	7	8
1.	Dehra Dun	56380.18	2259.29	54942.33	2789.11	56729.66	3608.24
2.	Saharanpur	368019.85	3456.41	370032.66	4339.92	382006.33	6378.96
3.	Muzaffarnagar	324025.78	4668.74	325284.66	5841.23	331878.33	8619.08
4.	Meerut	467243.47	4229.04	461999.66	5200.45	312269.00	8382.00
5.	Bulandshahr	376823.74	3230.43	374618.00	3633.53	339931.00	5786.39
6.	Aligarh	390667.18	2467.50	389149.66	3389.59	391132.33	4156.20
7.	Mathura	312676.46	2377.90	308230.66	2758.77	306554.33	3338.05
8.	Agra	356959.16	2165.87	356547.00	2485.84	343880.33	3359.67
9.	Mainpuri	275640.57	2350.65	282497.66	2985.16	283625.33	3779.74
10.	Etah	309624.25	2330.08	310350.66	3134.89	300735.00	3755.28
11.	Bareilly	324654.07	2765.32	327424.33	3039.20	334262.66	4411.51
12.	Bijnor	312061.13	3292.31	325401.33	3903.75	345522.00	6049.95
13.	Budaun	411881.47	1741.97	410098.00	2450.58	402734.33	3523.17
14.	Moradabad	471335.76	2488.91	474238.00	3201.75	481673.33	5597.79
15.	Shahajahanpur	335594.06	2032.31	319012.66	2330.41	346097.00	4166.48
16.	Pilibhit	199341.67	2845.81	201307.00	3724.37	219384.66	5643.26
17.	Rampur	184583.87	2857.10	188774.66	3369.68	189785.00	5390.78
18.	Farrukhabad	287678.24	2446.86	290728.33	2925.72	279336.66	4851.08
19.	Etawah	285944.30	2473.66	292009.00	3101.33	288069.66	4211.15
20.	Kanpur	431598.21	2245.62	432699.33	2635.16	425496.66	3668.18
21.	Fatehpur	284622.52	2309.76	291847.00	2476.98	298645.33	3339.08
22.	Allahabad	474790.65	2130.51	475871.66	2061.10	469331.33	3396.03
23.	Jhansi	439746.81	1456.66	476878.33	1538.89	303306.00	2081.92
24.	Jalaun	355832.72	1680.64	361342.66	1773.60	349296.00	2469.88
25.	Hamirpur	478862.52	1527.24	506500.00	1626.64	507934.33	1966.01

1	2	3	4	5	6	7	8
26.	Banda	462367.68	1877.67	489169.33	1906.74	487058.66	2292.84
27.	Varanasi	336382.87	2485.98	336534.00	2585.51	324302.00	3706.62
28.	Mirzapur	362044.75	1689.53	365572.66	1702.12	378241.33	2235.84
29.	Jaunpur	299730.64	2429.98	296088.66	2610.94	291329.66	4072.15
30.	Ghazipur	263220.43	2345.62	269456.66	3916.14	258961.66	3583.05
31.	Ballia	240545.15	2400.89	236822.00	2981.86	232944.00	3740.83
32.	Gorakhpur	477569.35	2244.71	474520.00	2737.52	482960.00	3776.32
33.	Deoria	443431.66	2906.06	441191.66	3399.18	441179.00	4832.84
34.	Basti	569049.94	2188.18	566041.33	2718.10	561060.33	3037.11
35.	Azamgarh	433878.64	2484.27	441398.00	2544.47	429729.33	3629.05
36.	Nainital	153512.41	3682.75	177304.00	4486.05	204607.66	6784.82
37.	Lucknow	147262.86	2079.29	153225.33	2544.48	148198.00	3339.29
38.	Unnao	285381.35	2011.66	291667.66	2463.18	279305.33	3077.18
39.	Rae Bareli	276392.25	2109.74	282569.33	2252.97	281066.33	3397.72
40.	Sitapur	432436.56	2221.51	428030.33	2588.19	420319.66	3183.69
41.	Hardoi	406996.24	2139.25	388032.00	3023.80	407172.00	3338.55
42.	Kheri	425205.85	2586.59	437175.66	2970.65	454163.66	4158.98
43.	Faizabad	301696.91	2820.35	302557.00	2843.07	298352.66	4396.41
44.	Gonda	522241.95	1855.98	519551.33	2334.98	499919.33	3041.43
45.	Bahraich	443540.04	1365.74	448460.66	1885.98	451146.33	2112.24
46.	Sultanpur	303120.22	2224.06	310574.66	2147.44	292802.00	3023.56
47.	Pratapgarh	238845.37	1934.28	249879.00	2081.75	225806.33	3202.41
48.	Barabanki	298993.13	2808.70	302730.33	3035.44	291104.33	4108.72
49.	Almora	-	-	-	-	110200.66	2033.95
50.	Pithoragarh	-	-	-	-	74043.66	2690.04
51.	Tehrigarhwal	-	-	-	-	73201.33	1789.66
52.	Uttar Kashi	-	-	-	-	31544.66	2193.24
53.	Garhwal	-	-	-	-	102204.00	1428.14
54.	Chamoli	-	-	-	-	45948.00	2244.44
55.	Ghaziabad	-	-	-	-	188734.66	6474.40
56.	Lalitpur	-	-	-	-	187857.66	1461.32

Source: Season and Crop Reports (Yearly) Revenue Board, Government of Uttar Pradesh, Lucknow.

Appendix VI

GROWTH RATES OF AGRICULTURAL PRODUCTIVITY

S.No.	Districts	Annual Compound Growth Rates (in %)		
		1968-71 over 1960-63	1980-83 over 1968-71	1980-83 over 1960-63
1	2	3	4	5
1.	Dehra Dun	2.6684	2.1690	2.3685
2.	Saharanpur	2.8862	3.2616	3.1113
3.	Muzaffarnagar	2.8402	3.2951	3.1129
4.	Meerut	2.6183	4.0580	3.4797
5.	Bulandshahr	1.4807	3.9537	2.9574
6.	Aligarh	4.0486	1.7136	2.6413
7.	Mathura	1.8744	1.6010	1.7103
8.	Agra	1.7373	2.5420	2.2194
9.	Mainpuri	3.0321	1.9861	2.4032
10.	Etah	3.7783	1.5161	2.4150
11.	Bareilly	1.1875	3.1539	2.3628
12.	Bijnor	2.1522	3.7184	3.0891
13.	Budaun	4.3587	3.0715	3.5845
14.	Moradabad	3.1982	4.7657	4.1359
15.	Shahajahanpur	4.2275	3.2746	3.6547
16.	Pilibhit	3.4203	3.5237	3.4823
17.	Rampur	2.0841	3.9933	3.2253
18.	Farrukhabad	2.2593	4.3039	3.4812
19.	Etawah	2.8670	2.5820	2.6959
20.	Kanpur	2.0197	2.7953	2.4843
21.	Fatehpur	0.8775	2.5200	1.8598
22.	Allahabad	-0.4132	4.2492	2.3586
23.	Jhansi	0.6888	2.5506	1.8018
24.	Jalaun	0.6752	2.7981	1.9436
25.	Hamirpur	0.7913	1.5916	1.2707
26.	Banda	0.1922	1.5485	1.0038
27.	Varanasi	0.4919	3.0472	2.0173

1	2	3	4	5
28.	Mirzapur	0.0928	2.2989	1.4107
29.	Jaunpur	0.9019	3.7733	2.6150
30.	Ghazipur	6.6167	-0.7380	2.1409
31.	Ballia	2.7459	1.9076	2.2421
32.	Gorakhpur	2.5120	2.7171	2.6350
33.	Deoria	1.9785	2.9759	2.5758
34.	Basti	2.7479	0.9291	1.6527
35.	Azamgarh	0.2997	3.0029	1.9130
36.	Nainital	2.4971	3.5077	3.1023
37.	Lucknow	2.5559	2.2911	2.3969
38.	Unnao	2.5635	1.8720	2.1480
39.	Rae Bareli	0.8244	3.4831	2.4113
40.	Sitapur	1.9280	1.7407	1.8156
41.	Hardoi	4.4207	0.8286	2.2504
42.	Kheri	1.7456	2.8438	2.4031
43.	Faizabad	0.1003	3.6993	2.2445
44.	Gonda	2.9115	2.2271	2.5003
45.	Bahraich	4.1169	0.9486	2.2042
46.	Sultanpur	-0.4373	2.8924	1.5474
47.	Pratapgarh	0.9227	3.6543	2.5529
48.	Barabanki	0.9752	2.5551	1.9202

Source: Season and Crop Reports (Yearly) Revenue Board,
Government of Uttar Pradesh, Lucknow.

Appendix VII

PATTERN OF INDEPENDENT VARIABLES: 1960-63

S1. No.	Districts	Fertiliser Consumption (Kgs/hectare)	Percentage of Gross Irriga- ted area to Gross Cropped area	Mechanisation Index (WPE/ 000 hectare)
1	2	3	4	5
1.	Dehra Dun	2.505	40.081	571.488
2.	Saharanpur	2.657	31.023	324.884
3.	Muzaffarnagar	5.050	68.142	435.585
4.	Meerut	5.425	77.960	324.918
5.	Bulandshahr	2.327	58.517	290.071
6.	Aligarh	1.068	49.801	241.227
7.	Mathura	0.565	41.585	221.240
8.	Agra	0.612	27.231	350.538
9.	Mainpuri	1.202	37.235	413.287
10.	Etah	1.781	37.844	334.357
11.	Bareilly	1.843	14.288	398.461
12.	Bijnor	2.710	13.038	440.132
13.	Budaun	1.324	16.583	375.359
14.	Moradabad	2.957	21.995	429.638
15.	Shahjahanpur	0.964	10.832	369.204
16.	Pilibhit	1.230	8.798	459.154
17.	Rampur	1.719	6.943	389.677
18.	Farrukhabad	7.220	28.527	413.453
19.	Etawah	1.068	36.728	518.564
20.	Kanpur	1.300	24.743	357.425
21.	Fatehpur	0.610	24.444	377.077
22.	Allahabad	2.087	19.954	429.854
23.	Jhansi	0.212	14.603	303.195
24.	Jalaun	0.687	21.861	198.107
25.	Hamirpur	0.106	11.280	217.411
26.	Banda	0.149	16.231	235.599

1	2	3	4	5
27.	Varanasi	2.754	43.213	423.788
28.	Mirzapur	1.286	23.870	433.957
29.	Jaunpur	3.440	46.943	557.097
30.	Ghazipur	2.080	35.423	453.278
31.	Ballia	1.254	32.727	366.103
32.	Gorakhpur	2.357	33.895	509.334
33.	Deoria	2.556	33.066	474.949
34.	Basti	1.311	38.823	526.741
35.	Azamgarh	0.758	45.784	755.615
36.	Nainital	3.031	26.366	NA
37.	Lucknow	3.233	25.113	494.361
38.	Unnao	0.498	22.368	378.260
39.	Rae Bareli	0.755	34.843	542.328
40.	Sitapur	1.190	10.092	467.861
41.	Hardoi	1.034	11.868	460.009
42.	Kheri	1.391	4.795	499.523
43.	Faizabad	3.774	44.748	537.407
44.	Gonda	0.774	21.566	384.568
45.	Bahraich	0.385	6.332	397.928
46.	Sultanpur	1.288	34.957	570.894
47.	Pratapgarh	1.886	37.207	601.966
48.	Barabanki	3.430	25.083	456.813

Sources: (a) Fertilizer Statistics (Yearwise), FAI, New Delhi;
(b) Statistical Abstracts of Uttar Pradesh (Yearwise),
Government of Uttar Pradesh, Lucknow.

Appendix VIII

PATTERN OF INDEPENDENT VARIABLES: 1968-71

Sl. No.	Districts	Fertilizer consumption kgs/hectare	Percentage of gross irrigated area to gross cropped area	Mechanisation index W.P.E./ 000 hectare
1	2	3	4	5
1.	Dehra Dun	18.601	44.435	904.322
2.	Saharanpur	30.743	54.436	1485.579
3.	Muzaffarnagar	46.392	91.582	1698.390
4.	Meerut	45.847	96.765	1245.913
5.	Bulandshahr	32.678	75.333	739.245
6.	Aligarh	18.245	70.732	615.512
7.	Mathura	11.781	59.607	742.912
8.	Agra	13.145	40.813	931.052
9.	Mainpuri	14.781	50.211	1020.780
10.	Etah	14.662	52.242	801.922
11.	Bareilly	19.785	35.673	1114.817
12.	Bijnor	23.916	37.101	1283.281
13.	Budaun	16.820	34.561	964.227
14.	Moradabad	25.051	43.037	785.573
15.	Shahajahanpur	13.979	29.600	1120.263
16.	Pilibhit	19.389	28.503	1346.576
17.	Rampur	25.837	23.415	1025.375
18.	Farrukhabad	29.038	35.165	1141.148
19.	Etawah	14.891	45.736	1443.462
20.	Kanpur	14.963	32.294	1112.901
21.	Fatehpur	8.196	29.805	930.201
22.	Allahabad	16.974	26.243	807.128
23.	Jhansi	3.060	21.145	209.334
24.	Jalaun	9.153	34.166	377.131
25.	Hamirpur	1.691	16.184	319.817
26.	Banda	1.892	16.297	437.507
27.	Varanasi	27.573	45.476	1116.095
28.	Mirzapur	8.600	28.353	839.388
29.	Jaunpur	26.035	46.895	992.192
30.	Ghazipur	16.708	37.774	883.626

1	2	3	4	5
31.	Ballia	18.973	37.317	661.432
32.	Gorakhpur	30.117	36.332	1614.970
33.	Deoria	33.116	44.651	902.485
34.	Basti	29.567	43.728	995.348
35.	Azamgarh	16.463	41.491	1357.701
36.	Nainital	38.349	34.794	1718.868
37.	Lucknow	19.716	39.073	1014.326
38.	Unnao	5.914	30.745	910.990
39.	Rae Bareli	9.634	43.213	877.636
40.	Sitapur	9.277	19.823	1063.140
41.	Hardoi	7.742	17.818	1063.141
42.	Kheri	9.572	11.015	1145.325
43.	Faizabad	43.592	48.511	1251.830
44.	Gonda	25.079	22.178	776.114
45.	Bahraich	8.438	8.519	861.245
46.	Sultanpur	23.425	37.036	713.776
47.	Pratapgarh	20.075	38.836	853.264
48.	Barabanki	36.195	33.509	880.104

Sources: (a) Fertilizer Statistics (Yearwise), FAI, New Delhi;
 (b) Statistical Abstracts of Uttar Pradesh (Yearwise),
 Government of Uttar Pradesh, Lucknow.

PATTERN OF INDEPENDENT VARIABLES: 1980-83

Sl. No.	Districts	Fertiliser Consumption (kgs/hectare)	Percentage of Gross Irrigated area to Gross Cropped area	Mechanisation Index (WPE/000 hectare)
1	2	3	4	5
1.	Dehra Dun	25.806	48.993	1405.535
2.	Saharanpur	97.487	78.366	2783.267
3.	Muzaffarnagar	105.960	97.372	3500.062
4.	Meerut	133.672	112.545	3217.749
5.	Bulandshahr	100.709	98.125	1510.075
6.	Aligarh	53.051	79.459	1374.906
7.	Mathura	43.467	74.962	1467.248
8.	Agra	53.656	55.036	1686.384
9.	Mainpuri	51.653	69.145	1645.890
10.	Etah	41.779	64.057	1325.382
11.	Bareilly	63.260	52.557	1644.533
12.	Bijnor	84.963	62.301	2928.940
13.	Budaun	55.834	43.879	1550.846
14.	Moradabad	71.651	70.035	2118.030
15.	Shahjahanpur	71.999	59.174	1986.600
16.	Pilibhit	90.396	65.480	1969.504
17.	Rampur	99.500	64.486	2004.611
18.	Farrukhabad	98.916	54.322	2362.916
19.	Etawah	62.761	64.336	1680.826
20.	Kanpur	50.663	53.249	1327.682
21.	Fatehpur	46.013	41.975	1239.167
22.	Allahabad	51.781	38.742	1238.752
23.	Jhansi	19.390	27.135	771.897
24.	Jalaun	29.614	25.954	980.782
25.	Hamirpur	6.255	17.024	532.452
26.	Banda	11.152	21.866	717.609
27.	Varanasi	86.002	66.160	1621.952

1	2	3	4	5
28.	Mirzapur	35.141	40.526	1190.886
29.	Jaunpur	79.816	44.138	1798.403
30.	Ghazipur	83.562	54.472	1840.434
31.	Ballia	73.082	45.309	1252.104
32.	Gorakhpur	57.618	46.518	1974.561
33.	Deoria	79.966	51.846	1663.030
34.	Basti	43.142	43.775	2027.138
35.	Azamgarh	49.552	53.607	2375.179
36.	Nainital	135.070	67.101	2384.656
37.	Lucknow	92.923	60.114	1959.680
38.	Unnao	46.726	57.061	1634.127
39.	Rae Bareli	52.312	56.620	1456.792
40.	Sitapur	38.924	32.588	1020.930
41.	Hardoi	38.033	46.036	1377.584
42.	Kheri	56.758	28.430	1864.223
43.	Faizabad	86.537	54.956	2096.765
44.	Gonda	39.234	29.095	1564.998
45.	Bahraiuch	3.588	15.509	1219.676
46.	Sultanpur	62.443	43.644	1251.480
47.	Pratapgarh	72.004	48.492	1492.889
48.	Barabanki	59.253	49.559	1475.923
49.	Almora	6.197	19.539	2758.938
50.	Pithoragarh	2.770	11.181	2259.801
51.	Tehrigarhwal	4.338	30.866	1063.324
52.	Uttar Kashi	11.869	30.874	1229.044
53.	Garhwal	3.517	16.338	747.764
54.	Chamoli	4.481	9.172	2009.529
55.	Ghaziabad	107.481	104.312	2412.720
56.	Lalitpur	15.453	30.921	553.750

Source: (a) Fertilizer Statistics (Yearwise), FAI, New Delhi;
 (b) Statistical Abstracts of Uttar Pradesh, (Yearwise),
 Government of Uttar Pradesh, Lucknow.

Appendix X

(CROPPING INTENSITY ($\frac{G.C.A}{N.A.S}$ x 100))

S.No.	District	1960-63	1968-71	1980-83
1.	Dehradun	138.84	148.97	153.78
2.	Saharanpur	138.24	144.61	156.92
3.	Muzaffarnagar	131.75	142.82	155.36
4.	Meerut	141.50	149.01	160.58
5.	Bulandshahr	140.41	149.05	166.76
6.	Aligarh	135.64	149.51	165.02
7.	Mathura	121.83	128.35	140.46
8.	Agra	118.56	122.35	134.68
9.	Mainpuri	131.30	137.41	146.41
10.	Etah	133.29	141.48	157.44
11.	Bareilly	127.62	131.84	145.26
12.	Bijnor	118.83	126.75	132.84
13.	Badaun	116.97	124.52	139.23
14.	Moradabad	118.00	130.07	146.96
15.	Shahjahanpur	119.10	129.77	142.63
16.	Pilibhit	127.75	138.52	157.71
17.	Rampur	138.44	142.64	155.94
18.	Farrakhabad	126.38	131.57	147.30
19.	Etawah	125.85	132.80	141.00
20.	Kanpur	122.15	121.15	130.40
21.	Fatehpur	121.33	121.75	131.72
22.	Allahabad	127.35	126.49	136.44
23.	Jhansi	110.91	110.72	111.14
24.	Jalaun	103.83	105.03	105.37
25.	Hamirpur	103.40	103.40	103.78
26.	Banda	119.81	117.88	122.37
27.	Varanasi	137.67	135.07	144.83
28.	Mirzapur	131.73	125.42	135.33
29.	Jaunpur	125.11	130.13	146.13

S.No.	District	1960-63	1968-71	1980-83
30.	Ghazipur	122.33	127.13	143.36
31.	Ballia	128.21	131.83	151.24
32.	Gorakhpur	133.10	134.52	151.66
33.	Deoria	128.83	141.83	148.26
34.	Basti	134.58	137.00	148.11
35.	Azamgarh	125.85	126.21	147.42
36.	Nainital	147.67	152.92	166.80
37.	Lucknow	127.98	144.48	139.14
38.	Unnao	131.17	133.61	140.34
39.	Rae Bareli	137.49	134.23	135.85
40.	Sitapur	128.54	127.28	135.94
41.	Hardoi	122.16	129.67	135.00
42.	Kheri	128.56	128.70	135.24
43.	Faizabad	138.63	138.55	152.03
44.	Gonda	140.76	140.15	155.44
45.	Bahraich	137.95	134.86	151.17
46.	Sultanpur	132.85	130.56	143.61
47.	Pratapgarh	128.62	125.05	139.49
48.	Barabanki	142.49	140.22	154.72
49.	Almorah	-	-	168.27
50.	Pithoragarh	-	-	179.81
51.	Tehri Garhwal	-	-	162.79
52.	Uttar Kashi	-	-	155.38
53.	Garhwal	-	-	150.04
54.	Chamoli	-	-	154.27
55.	Ghaziabad	-	-	163.75
56.	Lalitpur	-	-	126.25

Source: Season and Crop Reports (Yearly) Revenue Board,
Government of Uttar Pradesh, Lucknow.

Appendix XIIRRIGATION INTENSITY $\left(\frac{GIA}{NIA} \times 100\right)$

S.No.	District	1960-63	1968-71	1980-83
1.	Dehra Dun	131.45	146.01	148.61
2.	Saharanpur	113.75	130.85	139.99
3.	Muzaffarnagar	118.45	136.30	138.81
4.	Meerut	129.71	143.21	153.47
5.	Bulandshahr	123.68	131.88	148.29
6.	Aligarh	114.58	123.71	129.51
7.	Mathura	108.61	110.86	112.00
8.	Agra	103.11	103.42	105.43
9.	Mainpuri	111.66	110.53	117.80
10.	Etah	113.16	118.83	123.16
11.	Bareilly	102.38	121.03	127.19
12.	Bijnor	109.53	114.35	122.74
13.	Budaun	105.65	110.25	107.33
14.	Moradabad	102.46	111.82	122.04
15.	Shahajahanpur	103.34	119.33	128.18
16.	Pilibhit	102.68	120.11	153.23
17.	Rampur	106.28	118.73	134.62
18.	Farrukhabad	113.82	116.21	116.53
19.	Etawah	108.88	113.45	127.11
20.	Kanpur	107.72	110.27	124.16
21.	Fatehpur	109.76	110.29	120.21
22.	Allahabad	103.67	111.92	119.07
23.	Jhansi	109.89	101.17	101.81
24.	Jalaun	102.95	100.69	101.82
25.	Hamirpur	100.21	104.22	101.26
26.	Banda	106.91	110.83	129.69
27.	Varanasi	102.95	113.59	130.56
28.	Mirzapur	104.43	108.91	122.73

S.No.	District	1960-63	1968-71	1980-83
29.	Jaunpur	104.13	104.89	103.45
30.	Ghazipur	103.38	112.37	117.95
31.	Ballia	106.14	107.01	112.78
32.	Gorakhpur	101.15	102.64	103.54
33.	Deoria	104.67	125.21	113.44
34.	Basti	101.30	102.00	103.36
35.	Azamgarh	103.00	103.18	107.61
36.	Nainital	126.52	128.79	150.00
37.	Lucknow	110.33	122.22	120.71
38.	Urnao	106.00	109.94	125.28
39.	Rae Bareli	113.28	115.00	122.11
40.	Sitapur	102.82	102.35	107.04
41.	Hardoi	106.26	108.08	108.48
42.	Kheri	106.35	103.50	113.22
43.	Faizabad	107.57	107.26	118.19
44.	Gonda	103.65	111.75	101.64
45.	Bahrauch	102.04	101.48	100.62
46.	Sultanpur	101.82	102.53	107.29
47.	Pratapgarh	104.27	107.79	105.76
48.	Barabanki	110.43	116.21	120.04
49.	Almora	-	-	194.84
50.	Pithoragarh	-	-	173.54
51.	Tehrigarhwal	-	-	190.80
52.	Uttar Kashi	-	-	178.92
53.	Garhwal	-	-	170.16
54.	Chamoli	-	-	179.00
55.	Ghaziabad	-	-	154.17
56.	Lalitpur	-	-	102.12

Source: Season and Crop Reports (Yearly) Revenue Board,
Government of Uttar Pradesh, Lucknow.

Appendix XIIMEAN MONTHLY VARIABILITY AT SELECTED STATIONS
(in per cent)

Stations	Months					
	June	July	August	September	October	Annual
1	2	3	4	5	6	7
Dehra Dun	21.19	11.12	24.82	22.62	63.41	26.49
Roorkee	35.79	18.81	30.66	32.62	66.66	65.51
Muzaffarnagar	24.69	24.48	26.88	67.00	78.12	24.89
Meerut	26.92	15.99	28.16	61.76	52.50	42.09
Bulandshahr	40.90	22.62	46.61	43.30	80.55	32.82
Aligarh	46.26	32.53	20.39	42.85	61.11	34.92
Mathura	45.83	31.32	18.45	27.10	42.30	44.22
Agra	29.41	12.50	21.86	41.74	42.10	29.64
Barcilly	14.03	6.72	18.85	28.23	37.50	23.97
Moradabad	23.24	11.57	20.43	23.60	58.69	13.13
Pilibhit	26.60	12.62	21.83	29.90	41.17	24.50
Etawah	26.22	25.75	18.42	32.33	60.52	19.77
Allahabad	41.00	10.41	16.55	28.21	52.50	12.21
Jhansi	40.76	10.19	18.05	20.07	81.25	19.11
Jalaun	16.43	5.42	16.34	31.67	47.05	20.45
Banda	34.17	22.45	10.16	22.18	44.44	22.68
Mirzapur	24.19	21.17	14.93	33.83	42.50	26.35
Jaunpur	37.50	15.13	23.45	25.58	58.88	41.50
Ghazipur	25.00	12.19	17.10	26.75	33.92	41.96
Ballia	49.62	17.53	14.37	51.75	68.36	30.80
Gorakhpur	17.24	27.50	11.49	33.11	55.83	26.83
Deoria	17.78	19.14	16.02	32.51	49.12	22.22
Basti	11.45	16.46	16.99	24.59	45.76	16.65
Hamirpur	40.83	14.70	18.70	18.92	42.85	26.11
Naini Tal	32.02	18.57	29.89	20.43	38.79	40.06
Hardoi	32.65	34.34	14.07	23.65	43.75	36.65
Kheri	29.65	9.25	14.70	12.95	68.42	34.98
Gonda	28.57	24.71	19.09	17.44	46.87	20.00
Bahraich	23.37	26.61	24.32	24.38	45.00	23.91
Sultanpur	31.35	17.07	15.76	26.78	47.61	29.13
Bara Banki	23.07	23.93	17.79	15.86	36.48	30.45

Source: Census Atlas of Uttar Pradesh, 1971.

Appendix XIIIPRICES PER QUINTAL OF AGRICULTURAL COMMODITIES
(Constant Prices of 1981)

S.No.	Agricultural commodity	Price per quintal/ bale (in Rs.)
1.	Rice	225.97
2.	Wheat	146.55
3.	Barley	123.25
4.	Bajra	137.92
5.	Maize	138.82
6.	Gram	355.42
7.	Peas*	223.50
8.	Arhar	281.79
9.	Masur	337.66
10.	Urad	279.08
11.	Mung	340.75
12.	Sugarcane*	22.50
13.	Potato	77.12
14.	Cotton	437.50 (787.5 per bale)
15.	Groundnut	417.54
16.	Seasamum	634.83
17.	Lahi and Sarsoan	487.37
18.	Tobacco	497.72

Source: Weekly Bulletin of Prices, week ending Friday 1981, UP Government, Lucknow and *Agricultural prices of India 1975-82, GOI, New Delhi.

Appendix XIV

PROPORTION OF AREA UNDER NINETEEN SELECTED CROPS
TO THE TOTAL GROSS CROPPED AREA IN EACH DISTRICT
IN UP (in %)

S.No.	District	1960-63	1968-71	1980-83
1.	Dehra Dun	81.22	74.88	80.75
2.	Saharanpur	82.19	82.16	80.11
3.	Muzaffarnagar	79.04	79.89	81.86
4.	Meerut	80.24	81.55	79.08
5.	Bulandshahr	93.17	90.70	86.68
6.	Aligarh	93.14	93.50	90.74
7.	Mathura	91.03	91.27	88.46
8.	Agra	91.45	92.03	91.88
9.	Mainpuri	95.15	94.56	94.95
10.	Etah	94.67	94.82	93.46
11.	Bareilly	90.00	91.86	92.37
12.	Bijnor	87.50	87.20	85.93
13.	Budaun	96.40	95.65	95.06
14.	Moradabad	91.40	91.13	88.03
15.	Shahjahanpur	92.00	92.77	93.35
16.	Pilibhit	93.24	93.22	92.23
17.	Rampur	91.00	91.72	88.93
18.	Farrukhabad	95.40	96.16	93.57
19.	Etawah	95.52	95.46	95.32
20.	Kanpur	95.72	96.18	95.45
21.	Fatehpur	94.50	91.61	95.79
22.	Allahabad	92.00	91.14	99.94
23.	Jhansi	92.00	92.35	96.61
24.	Jalaun	95.77	96.75	95.54
25.	Hamirpur	95.10	96.22	94.83
26.	Banda	97.89	96.97	98.53
27.	Varanasi	82.24	87.13	90.50
28.	Mirzapur	76.46	77.25	83.15

S.No.	District	1960-63	1968-71	1980-83
29.	Jaunpur	91.55	93.29	94.51
30.	Ghazipur	88.11	90.05	93.71
31.	Ballia	88.72	89.93	91.41
32.	Gorakhpur	84.42	87.99	93.63
33.	Deoria	85.73	87.94	93.85
34.	Basti	86.64	89.97	92.23
35.	Azamgarh	89.41	95.11	94.76
36.	Nainital	90.08	89.63	88.54
37.	Lucknow	91.74	82.92	88.13
38.	Unnao	91.22	95.86	95.81
39.	Rae Bareli	88.23	91.07	96.49
40.	Sitapur	88.14	87.90	89.04
41.	Hardoi	93.32	96.83	97.44
42.	Kheri	87.83	91.26	93.81
43.	Faizabad	86.48	90.46	94.11
44.	Gonda	85.19	93.92	94.43
45.	Bahraich	88.64	93.78	96.20
46.	Sultanpur	82.15	85.04	88.97
47.	Pratapgarh	83.87	87.21	93.67
48.	Barabanki	87.33	89.16	92.74
49.	Almora	-	-	62.56
50.	Pithoragarh	-	-	73.49
51.	Tehrigarhwal	-	-	57.84
52.	Uttar Kashi	-	-	59.99
53.	Garhwal	-	-	55.99
54.	Chamoli	-	-	68.94
55.	Ghaziabad	-	-	82.03
56.	Lalitpur	-	-	89.48

Source: Season and Crop Reports (Yearly) Revenue Board,
Government of Uttar Pradesh, Lucknow.