A Study on Growth Pattern of Major Crops in Rewa District, Madhya Pradesh

THESIS

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By

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Date : **(Suneel K. Sharma)**
Place : Rewa

CERTIFICATE – I

This is to certify that the thesis entitled **"A Study on Growth Pattern of Major Crops in Rewa district, Madhya Pradesh"** submitted in partial fulfilment of the requirement of the degree of **Master of Science in Agriculture (Economics and F.M.)** of the **Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur** is a record of the bonafide research work carried out by **Mr**. **Suneel Kumar Sharma** under my guidance and supervision. The subject of the thesis has been approved by Students Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any degree or diploma (Certificate/Award, etc.) or has been published. All the assistance and help received during the course of investigations have been duly acknowledged by him.

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CERTIFICATE – II

This is to certify that the thesis entitled **"A Study on Growth Pattern of Major Crops in Rewa district, Madhya Pradesh"** submitted by **Mr. Suneel Kumar Sharma** to the **Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur** in partial fulfilment of the requirements for the degree of **M.Sc. (Ag.)** in the **Department of Agriculture Economics and Farm Management, College of Agriculture, Rewa,** has after evaluation been approved by the external examiner and by the Students Advisory Committee after an oral examination of same.

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VITA

The author of the thesis Mr. S/o Shri Suneel Kumar Sharma was born on 10th February , 1983 at Bhind, Madhya Pradesh.

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During all the period of her education, from schooling to post graduation he was very sincere and honest towards his studies.

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CHAPTER-I
INTRODUCTION

The trend growth rates of cereals pulses and oilseed are the impact of uses of improved seeds associated with adoption of modern cultivation practice. In this view during the last four decade Indian agriculture has witnessed a lot of technological changes which have caused tremendous effect on the production of various agriculture commodities especially with reference for cereal crops. Among the cereals rice and wheat have shown a sharp increase in production where as coarse cereals indicate sluggish growth or even decline in their output where as productivity of pulses is almost around 500-600 kg/ha with an annual growth rate of 0.68 per cent in the period between 1960-61 to 1999-2000 due to several constraints (C. Rama Swamy and K.N. Setvasa, 2002) while in case of vegetable oils during the last two decades India has become the largest importer of vegetable oilseeds (Acharya, 1993).

In Rewa District agriculture is the main occupation of the farmers and paddy is the major field kharif crop in which occupies an area of 129.60 ha, constituting about 65 per cent of the total area under food grains crops while other major crops are soybean, wheat and gram.

In this backdrop, the present study has been under taken to evaluate the trends in area, production and productivity of major crop in Rewa District in comparison with M.P. with the help of fitted appropriate linear functions of future projection of area, production and productivity of major crops in Rewa District.

Keeping in this view the following objective will be undertaken:

1. To examine the trend growth rates, fluctuation and potential of area, production and productivity in the study area.
2. To identify the major factors affecting the production and productivity of the major selected crops.
3. Suggestions and recommendations.

CHAPTER-II
REVIEW OF LITERATURE

In each research investigation, a review of research work done in the past on the problem undertaken presently for research work is explicitly necessary for the base work and needful improvements in the proposed thesis work. It also helps to the researcher to go further in his work for understanding the scope and difficulties in the present problem. The past work is helpful in delineation of problem area, provides a basis for conceptual framework, insight in to methods and procedures to be adopted. It also suggests operational definition of major concepts and provides a basis for interpretation of results. This chapter deals with the work already done in the past on the problem under investigation.

Pant (1983) Considered Madhya Pradesh state for growth rates on area, Production and productivity for the period 1956- 57 to 1964-65 and HYV period 1967-68 to 1981-82 He concluded that Madhya Pradesh agriculture is poised to 2 recovery from the shock, it received in the drought year of 1979-89, while wheat continues to be leading enterprise rice is still sluggish and cotton, groundnut and millets are receding out of these enterprise, pulses and oilseeds can come up vigorously, if besides technological inputs stocking policies for price support can be formulated.

Bhagat (1985) examined the role of economic and non-economic factors determining the farmers decisions officiating shift in inter crop acreage (of the crops grown during the rabi season) in the three region of Bihar during the period (1956-57 to 1976-77) with expansion in irrigation the acreage under wheat has tended to increase as indicated significantly. The rainfall received during the pre-sowing months shows a positive effect on the wheat acreage in all the three regions of Bihar in the pre HYV period. The study indicated the significant of relative gross return, rather than relative price, in explaining the variations in acreage under wheat crop across all the three region of Bihar. Availability of irrigation facilities during the rabi season and rainfall during the critical period are some of the other factors explaining the variation in area under wheat. The study

emphasized the need for reducing the occurrence of risk in order to maintain the production of wheat and the desired level of acreage under it.

George & Mukherjee (1986) analysed the change in the growth pattern and role played by technology high pattern and role played by technology high yielding varieties, irrigation and relative prices in explaining the changes in area, yield and production of rice in Kerala during the period of 1960-61 to 1983-84. This period was segmented was segmented in to two sub periods, period (i) 1960-61 to 1974-75 and period (ii) 1975-76 to 1983-84. They concluded that the growth rates of area, yield and production indicated considerable variations across the districts over seasons and over time. The growth rate of yield for second period was much higher than that for the first period during autumn and winter season for first period all the seven districts had positive growth rates of production associated with positive growth rate of both area and yield. The variability of area for the first and second periods indicated that during autumn, variability increased in one district (Kottayam) and declined in all other districts. The proportion of irrigated area turned out to be a non-significant variable in explaining paddy yield while the proportion of area under HYV had a significant influence on yield during autumn and winter.

Jain *et al.* (1988) analysed the growth rate of area, production and productivity of gram for the period of 1974 to 1984 in Madhya Pradesh and observed that in most of the division, there was positive growth rate of area of area, production and productivity of the crop. They further pointed out the major factors influencing the productivity of gram in Madhay Pradesh and farm Harvest prices.

Pal and Sirohi (1988) studied “sources of growth and instability in the production of commercial crops in India” and concluded that the growth and stability in the production of commercial crops were complementary rather than competitive process in intensively irrigated regions. There was no change in the frequencies of shortfall had increased over time and groundnut was the wrest-affected crop. Instability was more prominent in desegregated production at the state level and may be much higher at the farm level. There fore, concerted effort

should be made to safeguard the farmers against instability. The yield stabilizing policies in sugarcane, jute and potato would have greater impact on production stability.

Ashturkar and Kolhal (1993) studied the performance of area, production and field per hectare of the crop tur during the last 30 years (1960-61 to 1990-91) in all the regions of Maharashtra State. Showed that the area under the crop and its production have significantly increased in all the regions of the states except Pune and Kolhapur Productivity of its crop has declined or remained mostly stagnant in all the regions except Konkan and Nasik. Thus the production of its crop in the state has increased mainly due to the increase in area under the crop and not due to the increase in area under the crop and not due to increase in its productivity. The average per hectare yield of the crop in the state is less than the average for the country.

Ajjan (1993) analysed the performance of pulse in Tamil Nadu during the period 1950-91 compound growth rates were computed for area, production and productivity of pulses the results revealed that the share of pulses area and production in the total area and production of food grains in the state has stagnated during the first there decades and increased significantly during the last decade and it has doubled in 1990-91 over 1950-51. Analysis of growth rates revealed that over the whole period (1950-51 to 1990-91), Production of pulses was contributed more by productivity increase than by area expansion. Production faction results revealed that irrigation on contributed nearly two and half time more to production than area expansion.

Anatha Ram *et al.* (1993) analysed growth in area, production and productivity of rapeseed and the mustard and the factors associated with the recent production trends in Rajasthan and Western Rajasthan during the period 1974-75 to 1990-91. Area and production of rapeseed and mustard more than doubled between 1974-75 and 1984-85 and the increasing trend continued in the following period 1984-85 to 1990-91. The area under the crop grew at the compound growth rate of 9.5 and 12.8 percent per annum in western Rajasthan and Rajasthan State. The production of rapeseed and mustard grew at the

compound growth rate of 13.7 and 16.9 per cent in western Rajasthan and Rajasthan state respectively. The increase in area and production of rapeseed and mustard have been largely achieved through a shift in acreage from competing crops like barley and gram at the regional state and all India level. The reduction in relative yield risk and the profitability of the crop compared to the competing crops helped to increase the area under rapeseed and mustard.

Behura and Ray (1993) examined the growth and instability in pulses production in different districts of the state during 1980-81 to 1991-92. The compound growth rates of area, production and productivity of pulses in the state worked out to 1.77, 2.08 and 0.33 percent per annum respectively. The growth rates of area and production of pulses varied from –0.62 percent and –5.28 percent in puri district to 5.02 percent and 7.77 percent in Dhenkanal district respectively. The compound growth rates of productivity of pulses in Phulbani district has –4.40 percent and Keonjhar district has 7.32 percent per annum respectively. It clearly indicates that the farmers of the state don't have sufficient awareness of modern yield raising technology. The degree of instability in the area under pulses varied between 2.59 percent (Sambalpur) and 26.65 percent (Ganjan). The degree of instability in production and productivity of pulses varied from 38.86 percent (Keonj har district) to 34.85 percent (Puri district) & 5.17 percent (Mayurbhanj) to 29.37 percent (Keonjhar) respectively.

Borah and Dutta (1993) analysed the growth and area response of pulses and the relationship between changes in cropping intensity and the area under pulses in Assam during the period 1970-71 to 1991-92. They also examined compound growth rates of area, productivity of pulses. The significant upward trend in productivity has indicated a profound and visible transformation in pulse cultivation the growth of production was largely due to the expansion of our (2.16 percent per annum) rather than due to increase in the productivity of pulses. The declining trend in the production of the crop was mainly due to the declining trend in area under pulses justifying area as an ipso factor determinant of production of pulses. Lagged price and weather are the most important factors that influence the acreage under pulses like all other traditional commercial crops.

Gupta and Athavale (1993) analysed the first and last triennium ending 1972-73 and 1989-90 and observed that change in area, production and yield of soybean in all the measure producing state including the country as a whole showed a upward trend in the case of yield in Madhya Pradesh between the two triennia. The relative increase in area and production in Madhya Pradesh was also much higher them that of the country as a whole (5415 percent and 7315 percent respectively). In the case of yield of soybean highest in crease was observed in Rajasthan (52.7 percent), followed by Uttar Pradesh (47.9 percent) and country as a whole (34 percent). The decomposition analysis showed that the production of soybean is increased in all the major producing states due to increase in area. In the case of sunflower in Karnataka, the increase in production was mainly due to the interaction effect (53.5 percent) followed by area effect (45.3 percent) on overall basis, it may be concluded that the area was the dominant factor for the increase in the production of these two oilseeds.

Kandarpa and Hazarika (1993) examined the production behavior of pulses in Assam during the post-green revolution period, 1967-68 to 1989-90. The study revealed that the average annual compound growth rates of area and production of pulses in Assam are higher than the corresponding all India figures during the period under reference, but the productivity per hectare of pulses was found to be very low. The compound growth rates of yield per hectare of gram and tar were worked out to be –0.11 percent and –0.51 percent, respectively. The variability in area, production and productivity of various pulses computing the coefficient of variation with respect to each of the factors. Instability in the production of pulses was greater than that of acreage, and the maximum variability in area (28.66 percent) during the period very low acreage under pulses cultivation, lack of irrigation facilities, lack of credit, insufficient use of chemical fertilizer non-use of high yielding varieties are found to be the basic constraints hindering the growth of pulses production the state.

Mehtra and Grover (1993) Studies the growth rates and the variability in area, production and productivity of mustard and gram in Karnal and Bhiwani districts of the Haryana during the period 1960-61 to 1990-91. The area under

gram has declined at the rate of 15 percent in the West Zone in the last three decades due to strict adoption of rice-wheat rotation and availability of abundant irrigation facilities while in the dry zone the increase was non-significant at 2.2 percent. The variation in the growth of area under gram in the state was maximum at 24.70 percent. The area effect contributed the least in all the periods in the west zone while in the dry zone yield effect on value of production was positive. The area, yield and production of rapeseed and mustard have increased at the rate of 4.8, 3.2 and 6.6 percent respectively in the dry zone, whereas the area under oilseeds has declined significantly in the wet zone. In the dry zone the variation in production has been the highest (49.44 percent) yields in the wet zone should be increased by evolving high-yielding varieties and the area under gram and oilseeds in the dry zone needs to be increased for achieving higher production.

Narender at el. (1993) examine the trend in area, production and productivity of pulses in different states of India during the period 1950-51 to 1989-90 and to identity the constraints in increasing the productivity of pulses. The compound growth rates of area, production and productivity of gram, tur, other pulses and total pulses were worked out for four sub-periods for the country as a whole. During period I (1950-51 to 1959-60), the growth rate of area and production under gram was significant at 4.15 percent and 6.55 percent per annum respectively. All other periods both area under and production had recorded a negative trend. Both area under and production of tur had indicated significant positive growth in period IV (1980-90 to 1989-90). Significant positive growth rates were in the area, production and productivity over the whole period. Increased production of different pulses was due to increase in area only but not due to technology improvements some general constraints are identified are lack of adequate supply of improved seed, lack of drought tolerant varieties, lack of varieties resistant to diseases, attack of pests and disease.

Patil (1993) to estimate and analysed the compound growth rates in area, production and productivity of pulses in Karnataka during 1980-81to 1990-91. The dates reveal that the area under pulses increased by 1.02 percent per annum, while the area under all cereals increased by 1.29 percent per annum. Productivity

of all pulses increased by 2.93 percent and productivity of all cereals increased by only 0.97 percent per annum. The imported pulses, green gram recorded the highest growth in area at the rate of 5.20 percent per annum other grams reported negative growth rates of area. Among all pulses, the growth rate in productivity of black gram was the highest and positive at 7.01 percent. Area under all grams the compound growth rate was negative for the entire nineteen districts and in the case of production Shinoga district, all other districts have shown negative growth rate. The study shows that the growth rate of production and productivity shows that the growth rate of production and productivity of pulses have increased moderately in the district of Shinoga, Kolar, Chitradurg, Gulbarga, Belgaun, Utterkannada, Bihar and Dharwad due to soil and climatic conditions are favourable, are most suited for pulses production.

Prasad *et al.* (1993) examined the share of pulses in total food grains production had declined from 10.90 percent in 1970-71 to 7.33 percent in 1991-92 resulting in the reduction of net availability of pulses from 51.20 gram per capita per day to 36.85 gm. Against the recommended level of 80gm. The main reasons for this declining trend may be attributed to stagnation in the production of pulses on the one hand growth in population on the other. Production Performance of pulses during the last three decades identifies the constraints responsible for blow growth of pulses. Climatic factors play an important role in yields fluctuation of pulses high temperatures and moisture stress greatly affects flowers drop and bud abortion.

Rai *et al.* (1993) examined the compound growth rates of area, production and productivity of rapeseed mustard, groundnut and til three major oilseed crops and oilseed as a whole in Uttar Pradesh were worked out for 30 years (1960-61 to 1989-90). Negative growth rate in area, production and productivity of all the three-oilseed crops separately and total oilseed as a whole during the study period. In the decade 1970-80, the area and production of rapeseed mustard in creased at the rate of 2.47 percent and 0.72 percent per annum respectively while productivity decreased at the rate of 1.47 percent per annum. The annual growth rate of area, production and productivity of total oilseeds was 12.5, 4.55 and 3.26

percent respectively during the period of 1980-90. It is there fore, incentive prices, profitable technology, efficient supply of inputs to the farmers, plenty of raw materials with low cost technology for processing industry are major factors should be adopted to accelerate the growth in oil seed production in Uttar Pradesh.

Rahone and Joshi (1993) examined the area, production and productivity of some important oilseed and pulse crops in Maharashtra during the period from 1966-67 to 1991-92 and revealed that the area, production and productivity of sesamum, sunflower, and tur had increased significantly. But in the case of groundnut, there was an increase in its production and productivity only. The production of gram has increased significantly at the rate of 4.18 percent per annum, which was equally contributed by a significant increase in area and productivity, mainly due to the introduction of irrigation facilities, improved technology and high yielding varieties.

Singh and Lal (1993) examined the impact of both the price and non-price factors on acreage of eatable oilseeds in the major croping states in the country during the period 1968-69 to 1990-91. For this study three oilseed, namely, groundnut, rapeseed and mustard were selected for analysis on area, yield, rainfall, net irrigated area, farm harvest price of edible oilseeds. Study revealed that supply price relationship of oilseed was positive but weak in most of the state. The oilseed acreage response to relative price was significant. The yield of own crop had positive impact on acreage of crops in almost all the states. The yield of own crop had positive impact on acreage of crops in all the states. The other non-price factors such as expansion of net irrigated area in the state and rainfall in the seasons showed a weak positive and negative impact on acreage of oil seeds in almost all the states. The finaling of this study lead to a few important policy implications. The agricultural research efforts should be made towards variety improvements in oilseed crops for increasing their yields, which have significant impact on a crease.

Singh *et al.* (1993) analysed the area, production and yield of major food and noon food crops in India during the year 1960-61 to 1992-93. The study revealed that in the case of total food grains as well as for all individual food grain

crops, yield witnessed higher growth rates as a compared to change in the last two decades. This has helped in maintaining a rising trend in total food grain production at the national level. In the case of non-food grain crops, oilseed maintained steady trend in growth rates during the last two decades. Cotton maintained an increasing trend in its production and yield growth rates over the year at the national level. The findings further revealed that increased use of irrigation water, fertilizers and HYV seeds could further increase the yield of food grain crops in most of the states. The main determinants of agricultural performance were found to be the total cropped area, yield per hectare and irrigation water, closely followed by regulated markets and rood network.

Singh *et al.* (1993) has registered remarkable growth during the last 25 years from 1966-97 in oilseeds production in Haryana, with an annual growth rate of 8 percent. Rapeseed and mustard are the main crops almost the oilseeds which accounted for more than 92 percent of the total area sown and for 98 percent of the total oilseeds production in the state. The area sown, production and yield of rapeseed and mustard have increased at the rate of 4.80, 8.80 and 3.96 percent respectively. Groundnut and linseed and other oilseeds have shown a continuous decline in area and production at a higher rate. This high rate of growth or decline is also accompanied by large year to year variability in the area sown, production and yield of all crops, which is the most undesirable and unavoidable phenomenon of productivity based growth. This variability in area, production and yield could have been due to the vagaries of nature and incidence of insects.

Singh *et al.* (1993) analysed the growth in area, production and productivity of oilseed crops in India during the period 1970-71 to 1988-89. The period is divided in to two-sub period, 1970-71 to 1979-80 and 1980-81 to 1988-89 higher growth rates of area. Production and productivity of oilseed during the period 1980-81 to 1988-89 as compared to the period 1970-71 to 1979-80 among all the oilseed crops, rapeseed and mustard have shown a greater degree of responsiveness to TMO efforts. Among oilseed crops, the area under groundnut and its production were the highest. Proper implementation of TMO directives and timely and assured availability of quality inputs at reasonable prices at the farmer's

doorstep may held in increasing oilseed production. The TMO has been working to help boost the oilseeds production and productivity by means of incentive prices better technology efficient supply of inputs and services these measures have helped to achieve higher growth rates of area, production and productivity of oil seeds during the period 1980-81 to 1988-89.

Singh (1993) examined the pattern and rate of growth of pulse production in Bihar during 1968-69 to 1989-90. The results revealed that in spire of the criticism against Khesharidal. Khesharidal & gram which accounted for 31 & 17 percent of the area under pulses respectively and there corresponding share in the total production of pulse was 31 & 18 percent. Area under all pulse crops except masoor has decreased in the state during the post-green revolution period. Production of pulse crops except masoor declined by 30 percent during this period. Productivity per hectares of all pulses crops except pea has increased significantly. The growth rate analysis showed that the area under pulse crops declined by 2.06 percent per annum in the state. The production trend of pulses was also negative rate of reduction was 0.48 percent. The average productivity of pulses increased by 0.64 percent per annum. Overall variability in the productivity of pulse crops was 33.12 per cent, which varied from 20 to 34 percent and the variability in area and production was 15.29 and 13.67 percent respectively. In order to increase total production of pulses particularly yield per hectare, it had essential to evolve some new high yielding varieties & crop insurance scheme to cover pulse crops.

Shrivastava and Thakur(1993) analysed the performance and prospects of important pulses grown in Madhya Pradesh. Area, production and productivity of selected pulses (gram, tur and urid) were used pertaining to the period 1980-81 to 1989-90. The area, production and yield of gram in the state increased by 6.15 percent, 9.32 percent and 2.90 percent respectively. The area, production and productivity of tur were –2.06,3.08 and 5.26 percent respectively. The area under all the pulse in the state showed a marginal decline by 4.94 percent. However, the total pules production and yield in creased by 10 percent and 16.3 percent respectively. On the whole, the rate of growth of area, production and productivity

under pulse was- 0.58, 1.50 and 2.14 percent per annum respectively. As regulars total pulse, the study revealed that the increase in production was due to the use of higher and better in puts and improved technology.

Sale *et al.* (1993) examined the performance of oilseed crops in four broad regions of the state during the period of 32 years from 1956-57 to 1987-88 and the relative importance of area expansion and productivity improvement. The compound growth rate of area, production and productivity of important oilseeds during the three period, viz. period I 1956-57 to 1966-67, period II 1967-68 to 1976-77 and period III 1977-78 to 1987-88 as well as for the over all period of 1956-57 to 1987-88 were estimated. The growth rate in area, production and productivity of oilseed crops varies greatly among the regions. The output growth rates of safflower were positive and significant over all the regions. The growth rates in area, production and productivity of kharif groundnut were dismal in all the regions during different time periods. Sesamum also suffered badly during the sixties and the early seventies. Significant improvement in the performance of sesamum crop during the late seventies and eighties. The performance of sunflower and summer groundnut was quite satisfactory. Some of the existing HYVs of groundnut, safflower, sunflower and sesamum deserve cum consideration for their widespread adoption at the form level. Sarker (1993) examined the impact of modern agriculture technology on production, productivity and marketing of some major oilseeds and pulses production of improved agriculture practices like irrigation and HYV facilities has been very effective in increasing the production and productivity of all main oilseeds and pulses in the study period. High positive relationship is noted in the output of mixed crop mustard. It is also observed that the cultivation of maskalai, without significantly reducing its productivity and with the lowest production cost per unit of area.

Sharma and Tewari(1993) examined the growth trends and magnitude of fluctuations in the productions of pulses in Himachal Pradesh. The area, productions and productivity of these crops have decreased drastically over the years. The major reasons for decrease in area were the low level of output-input rations of these crops. The main causes of decline in the productivity of these

crops included the reduction in the irrigation area under these crops; less use of purchased inputs; poor management practices; poor yield potential of existing varieties; The declining trend in productivity was accompanied by increased fluctuations in pulses. The range of production instability has increased in the post green revolution period. Pulses exhibited instability of a higher order. Declining productivity contributed more to the decline in the production of red gram, black gram, lentil, other pulses will decrease in production due to area was predominant in gram and green gram.

Shiyani and Jha (1993) carried out decomposition to measure the relative contribution of area, yield and price in increasing the production of oilseeds pulses and cereals crops. The price factor individually contributed much more in almost all the crops, except rapeseed- mustard and other, for which the area factor was more powerful. The evolutions of high-yielding varieties for pulse and remuner active support price better marketing facilities are major factors to increase the production of these crops in the state.

Shree Ram Raju (1993) examined the production response of pulses in different regions of Andhra Pradesh. The study period during covering 35 years data's from 1956-57 to 1990-91. They revealed Bangal gram showed significant & positive response only in Rayalaseema region. In other regions and in the state as a whole, its response was negative & non-significant. Red gram exhibited significant reopens only in coastal Andhra and Rayalaseema regions. All the regions and state showed negative and significant response for green gram. Coastal Andhra Rayalaseema and negative in Telangana. The development of high-yielding verities of pulses, availability of adoptable technical know how and a remunerative and stable price policy due to a long way in the increase of area and production of pulses in three regions of Andhra Pradesh.

Upadhayay and Sharma (1993) identify the factors responsible for changes in pulse production over the period 1970-73 to 1986-89 in different regions of Uttar Pradesh. The study Indicate that output of pulses declined in the first period (1970-73 to 1978-81) and increased in the second period (1978-81 to 1986-89. Area under pulses during in the first period was about 74 percent and productivity 47

percent to the negative growth in output. During the second period area and productivity accounting for 34 percent and 46 percent respectively. In the first period negative growth in the output of pulses in all regions of Uttar Pradesh except the southern region. In the second period positive growth in output was mainly due to the increase in the productivity of pulses crops. The expansion in the area under paddy and wheat due to the introduction of irrigation and fertilizer responsive varieties of these crops resulted in the adoption of single crop cultivation of rabi pulses in particular as a result of which there was a general tendency of lower allocation of area to pulses crops in the initial years after the green revolution.

Jena et. al (1994) discussed the effect of new technology on groundnut production and the stability arising there from in Orissa. The study has been divided in to two periods, period (i) pre techno period of 18 years (1954-55 to 1971-72) and period (ii) post techno period of 20 years (1972-73 to 1991-92). The result revealed that the instability in both area and production was convergent in nature except in the Kharif season in Dhenkanal and Ganjam districts and in the Rabi season in Puri and Sambalpur districts. They also observed that the very objective of the new technology for increasing the production through yield augmentation program has not been achieved so far.

Sharma and Joshi (1995) examined temporal and spatial performance of rice in terms of its area, production and yield and the factors responsible for determining the acreage and yield of rice during the period 1970-71 to 1988-89. They concluded that the proportion of rice acreage in the kharif season to total rice acreage is substantially higher as compared to the rabi season in all the coastal districts except in Nellore in Andhra Pradesh. The growth rate of area under rice is negative in a majority of the districts during rabi season is significantly positive in a majority of the districts and the growth rate exceeded 3 percent in more than hart of the districts the growth rate of rice acreage was higher than the growth rate of yield. Consequent up on the growth in area and yield the production of rice increased in the region. The area under rice expanded largely due to relatively

higher profitability and low yield uncertainty as compared to other competing crops expansion of irrigation facilities, HYV and price incentives.

Arya Anites (1997) an attempt was made to improve production through supply of inputs and efforts were made to improve rural infrastructure during the period 1950 to 1960. The green revolution gave boost to the morale of the economy by achieving significant upward shift in the production of food grains. Public investment for agriculture sector from the sixth to the right plan has ranged from 20 to 24 percent of the total outlay. The annual growth rate in food grain production during the period 1984-85 to 1994-95 is 5-6 percent. The coverage of high-yielding variety seeds increased from 1.9 million hectares in 1966-67 to 73.5 million hectares in 1994-95. The consumption of chemical fertilizer increased from 13 lakh tones in 1955-56 to 14.1 million tones in 1994-95. The growth rates in yield has not decelerated but moved up after 1980-81 both in Punjab and Haryana in dictating that the potential yield have mot declined over time. This implies that in further yield growth may be sustain in these states.

Das (1997) examined the area, production and yield of food grains, sugarcane and jute, total area under high yielding varieties (HYVs) area under HYV rice and wheat in the states of the region and the national level. The performance of agriculture during the period 1976-77 to 1995-96 in the eastern region. Orissa secured the highest index of agriculture efficiency (106-68), during the study period. In the state of the eastern region the diffusion of new agricultural technology and consequently the rate of agricultural growth are show not only because of the absence of institutional and infrastructure facilities of credit, irrigation, marketing etc. but also due to unproductive agrarian structure being characterised by the existence of exploitative tenancy, fragmentation of holdings and under utilization of land, water and other resources of the large farmers.

Dhindsa and Sharma (1997) stated that the negative growth of production of pulses come mainly attributed to a decline in area and stingray in the yields of various pulse crops.

Gupta (1997) examined the compound growth rate of area, production and yield of groundnut in different state and country as a whole during three time

periods, period I (1971-72 to 1980-81), Period II 1981-81 to 1990-91 and period III 1971-72 to 1990-91 and reported that the orrias is highest positive and significant compound growth rate for area (6.34 to 9.85 percent) and production (6.09 to 10.95 percent) while Punjab witnessed negative C.G.R. in area (-26.79 percent) production (-22.1 percent) of groundnut. Madhya Pradesh and Uttar Pradesh had also experienced consistently negative C.G.R. during the whole period. Tamil Nadu turned up from negative growth rate in period I to positive and significant C.G.R. for the area (1.28 percent) and production (1.32 percent) during period II. The positive growth rate of area under groundnut was responsible for the increase in the production of the crop for the country as a whole, the C.G.R. for area, production and field was 0.73, 2.06 and 1.33 percent per annum respectively and it was highly significant. Groundnut cultivation should be increased under assured irrigation in all those states. Thus assured irrigation will not only reduce the variability in production but also sustain the yield.

Naik and Behura (1997) examined the growth of individual crops in different time frame, inequalities created in the productivity of different crops in different regions and the productivity opportunities availed by the different forming communities in different regions of India, and observed that the area growth under oilseeds was negative during the seventies and eighties and started in creasing significantly in the eighties. The performance of individual crops also differed widely among the regions and within each region. The growth of area under rice, wheat and food grains which was 0.77 percent, 2.94 percent and 0.51 percent respectively. The increase in the production of food grain (2.79 percent) during 1980-81 to 1993-94) was mainly due to improvement in productivity. The productivity growth of food grain was 2.69 percent. The total food grains production in eastern can be increased it the productivity of rice is increased significantly.

Prakash *et al.* (1997) examined the factor responsible for disparate growth in different states and to suggest the strategy to increase the production of pulses during the period 1969-95. The study revealed that the area and production of chickpea have drastically come down in the stoke of Haryana and Punjab while

the area and production have gone up in Maharashtra and Madhya Pradesh. Area, production of mung bean an appreciable increase in Bihar & Gujarat while Utter Pradesh and Madhya Pradesh showed considerable decline in area and production. The productivity increased in Punjab and West Bengal while it has gone down in Haryana. The production of pulses in the country increased due to selecting high yielding and disease resistant varieties and adoption plant protection measures.

Singh and Gupta (1997) analysed the regional variation in area soon, net irrigated area, fertilizer consumption, area and productivity of two major crops grown, namely sheet and oilseeds (rapeseed and mustard), in the eastern regions and western regions of Haryana. The study pertained to the triennium ending 1982-83 and 1992-93 and reported in the western region. In the western region the per hectare use of fertilizer increased from 27.4 kg. While in the eastern region the per hectare use of fertilizer increased from 70 kg during the first triennium area under wheat went up by about 48 percent in the western region during the second triennium while it increased by only 7 percent in the eastern region. The area under rapeseed and mustard crop increased by 88 percent during the triennium ending 1992-93, while in the eastern region this increase was 106 percent. It is significant to note that the productivity of this crop went by as high as 92 percent in the western region as against 38 percent in the eastern region.

Singh and Priyaranjan (1997) examined the contribution of production components like land, irrigation, fertilizers, high-yielding varieties (HYVs) and rainfall to food grain production and growth there of during post green revolution period (1970-71 to 1993-94) in North Bihar. The annual growth rate in food grain production was estimated at 2.7 percent during the study period but it was comparatively higher in the eighties (4.5 percent) than the growth rate achieved in the seventies (3.3 percent). During the early nineties the growth performance of food grains production showed a marginal decline (4.2 percent). But it was only due to low rainfall in the region contribution of production components to food grain output revealed that the rainfall and gross cropped area are still in a position

to explain the respective variation of 24.90 percent and 20.91 percent in food grain production in the project area. Irrigation has explained only 16.29 percent of the variation in food grain production, probably due no inefficient canal system, non-functioning of public tube well, erratic supply of electricity and inadequate availability of fuel in the project area.

Sharma *et al.* (1997) examined the regional variation in the spread of new agricultural technology in terms of adoption of HYVs seeds, and fertilizer consumption and the trend in area, production and productivity of major food grain & nonfood grain crops of eight major mountains states of India pertained to the period from 1970-71 to 1992-93. In Assam, the gross cultivated area increased by 70 percent between 1970-71 to 1990-91. How ever, it is worth nothing that the gross irrigated area did not change at all. On an all-India level, the gross cultivated area increased by 12.13 percent as against 63.57 percent increase in the gross irrigated area. This led to as increase in the irrigated area as a preparation of cultivated area from 23 percent in 1970-71 to about 34 percent in 1990-91. The compound growth rates for the total fertilizer consumption for the period 1970-71 to 1992-93 and show that all the growth rates were found to be significant in all the states. The compound growth rates were found to be higher in the eastern states. A wide range of disparities in productivity vas observed among different mountainous states. Thus the result have shown that the variations are particularly distinctive between the three and eastern states.

Sardana *et al.* (1997) examined the agriculture performance of different districts (regions) of hargana during the green revolution and post green-revolution period, its growth and variability and the important factors determining its performance. The value of agriculture produce per hectare has increased in all the districts during the period 1970-1990. The states annual growth rate was 3.31 percent during 1975-83 and it rose to 4.27 percent during 1983-95. The highest annual growth looks place in sirsa districts due to rapid development of irrigation and other infrastructure. Agricultural performance is largely dependent on HYVs and fertilizer consumption but lavel of dependence has reduced over the period. There has been reduction in disparities among districts of Haryana with regard to

agricultural performance (value of agricultural produce per hectare) during the last 25 years. The potential for growth in agricultural performance with the existing technology lies in the back word districts only.

Shete *et al.* (1997) examined the compound growth rates of area, production and productivity of total cereals, pulses, oilseeds, sugarcane and cotton crops during different time period viz. period (I) 1956-57 to 1966-67, period (II) 1967-68 to 1977-78 and period (III) 1978-79 to 1989-90. The increase in the production of cereals during period (I) noted the productivity of positive decline in period (ii) Maharashtra contributed to be the deficit state in oilseed production during the sixties and seventies but experienced some dramatic change in production during the eighties. The increase in the production of cereals during period I was due to area expansion and during subsequent periods it was combined with productivity improvements in all the regions. The factor analysis revealed that the development of agriculture was uneven in the different regions of Maharashtra. The aggregate crop output depended largely on the magnitudes of cropping intensity, followed by the use level of fertilizers and improvement in capital-labour ratio.

Parameshwar *et al.* (1998) investigated the supply behavior of agricultural commodities as following nerlovion analytical frame has been an area of interest for many scholars in India during of interest for many scholars in India during last three decades. The study reveled that work out the farmers response to price & non price factors in the production of groundnut during the last two decades price & trend factor registered positive influence and relative risk factor extend their negative relation risk factor extend their negative relative on groundnut production, the result would be of policy use (price policy & infra structural development) for augment groundnut production in the Karnataka state.

Mehetre *et al.* (2000) in the present study the compound growth rate in area, production and productivity have been estimated using exponential model, Western Maharastra: During 1st time period (1961-62 – 1980-81). 3rd under cotton crops was 4.12 lakh ha, which was reduced considerably during 2nd (1971-72 – 1980-81), 3rd (1981-82 – 1990-92) and 4th (1991-92 – 1997-98) time period (2.75,

3.41, 2.42 lakh ha). During time period 3rd areas is increased slightly as compared to time period 2nd. The average area of cotton crop was 2.86 lakh hectares during phases B. It was 36.36% less than phase A.

Nandi and Kant (2001) studied that different linear and non-linear functions growth models are fitted for estimating the growth rate and on that basis it is observed that the area under the total food grains crop is declining due to the replacement of area by different cash crop.

Dhillon and Ali (2002) observed that the introduction of the package of green revolution and its wide adoption has changed the agricultural scenario of Punjab. Extensive use of modern inputs has increased the production and productivity of some crops, particularly rice and wheat, over the years. But in recent years, the productivity growth of most of the crops has decelerated significantly, which is of serious concern. There has been a sharp decline in the area under soil protective crops like pulses and oilseeds largely due to adoption of high yielding varieties of rice and wheat and rotation of these two crops. This has resulted in soil degradation. The extensive use of chemical fertilizers and irrigation has rendered the ecological balance towards insect pest, diseases and weeds.

Ramasamy and Selvaraj (2002) concluded in this study that the fitted model resulted that the growth in pulse and oilseed production has not kept pace with the population growth, resulting an overall decline per capita availability and generally higher prices for pulses and edible oils. Change in consumption pattern effect the growth of coarse cereal.

Siddalingappa *et al.* (2002) examined the influence of infrastructure, regional, agro-climatic and socio-economic factors on the productivity of crops in the dry agro climatic zones of Karnataka, India. Infrastructure, regional and agro-climatic factors had a positive impact on the productivity of major crops. The influence of infrastructure variable was stronger compared to regional variables (eg. forest cover, rainfall etc.) and socio-economic) and socio-economic variables. Irrigation development was essential for improved productivity.

Singh and Shrivastava (2003) studied the area, production and productivity of sugarcane for western, eastern and central (including Bundelkhand) as well as

for the state with reference to the period 1980-1981 to 1998-99. Area & predicting under sugarcane registered a significant and positive growth rate in all the regions. Production was also registered a significant and positive growth in the three regions. Though significant and positive growth in the production of sugarcane has emerged as a common feature in all the three regions of the state, its magnitude is not uniform across the regions. This calls for adequate measures to improve location specific production technology through research development and extension efforts and also through ensured input supply mechanism. Further cane production instability is observed in the state with its varying magnitude across the regions. Area instability is the major source of production instability.

Malik *et al.* (2004) examined the area, production and productivity of onions during the period 1983-2000 worldwide, and state wise in India. The quantity and value of Indian onion exports (1990-2001) are also examined. It is revealed that significant growth in areas, production and productivity was recorded worldwide and in the major producing states of India. On the other hand, India exports have declined.

Singh *et al* (2004) reported that Punjab has been well known for productivity increase by more than 5 times in five decades (1950 to 2000), area by three times and the production by more than 15 times. Its productivity continues to increase at the growth rate of more than 2 per cent. Its yield variability across districts has declined over time. Various efficiency parameters were not in any uniform association with farm size. The constraints to efficiency have to be found more in terms of the structure and level of inputs use rather than the achievement of outputs in case of wheat. The share of machinery was already high by mid 1980s, indicating significant levels of mechanization of Punjab agriculture having taken place by that time.

Nahatkar *et al* (2005) made an attempt to ascertain the growth pattern of soybean production in major soybean growing agro –climatic zones of Madhya Pradesh for the period of 1981-2001 using secondary data on area, production and yield. They concluded that the higher growth in production of soybean in the state was due to significantly higher growth of area (horizontal expansion) followed

by moderately better growth in productivity (verticals expansion). The growth of soybean production during first decade (1981-1990) was higher (25.07%) as compared to the growth (6.92%) during second decade (1991-2001). This clearly indicates that the for the increase in soybean production is only possible through breaking yield barriers and reducing exciting yield gaps (up to 7 q\ ha) through increasing rate of adoption of production technologies along with supply of quality input. There is a need to identify the focal point of intervention after assessing and prioritizing biotic and abiotic stress for different agro –climatic zones and within zones for different agricultural production systems (micro-situation).

Prajneshu and Candran (2005) stated that growth rates are widely employed in the field of agriculture as these have important policy implications. The usual parametric approach for growth rate analysis is to assume multiplicative error in the underlying nonlinear geometric model and the fit the linearized model by 'method of least squares'. The deficiencies of this approach have been highlighted. It has been argued that nonlinear estimation procedures should be employed for fitting the model and then only the growth rates should be computed. A methodology has been discussed to compute the compound growth rate by using growth models, viz., monomolecular, logistic and Gompertz. Firther, as an illustration, the total food grain production of our country during the period 1980 to 2001 has been considered and its growth rate has been computed.

Vitonde *et al* (2005) examines the growth and instability in area, production and productivity of important oilseeds and pulses, *viz*. safflower, groundnut, soybean, mung, urid, tur, and gram for period 1970-71 to 2000-2001. The time series data have been collected from the Govt. Publication of Joint Directorate of Agriculture, Amaravati Division (MS). The data have been analyses by fitting exponential function to estimation of growth rate and coppex instability index model for measuring instability. Chow's test was used to measures the structural changes during different periods. The study was performed during three periods: 1970-71 to 1979-80 (period I), 1980-81 to 1989-90 (period II) and 1990-91 to 2000-2001 (period III) (the periods after Green Revolution). The growth rates of area production and productivity have shown mixed trends. Groundnut crop has

noticed a negative growth rate during all the periods, soybean crop has registered maximum growth rate during the study period in all the districts. The maximum instability has been found during period III for most of the crops. Equality of growth rate (structural changes) has been observed for the area, production and productivity in different district for the crops. Increasing trend has been observed in respect of area, production and productivity in the western Vidarbha for all the crops. Productivity level was maximum during the second period due to adoption of new technologies, improved varieties and disease and pest management during this period.

Yadav *et al* (2005) collected the secondary data from Statistical Abstracts of Haryana, and using these data as the estimated coefficient of variation, they found that production of cotton (American) (30.48 per cent) and wheat (36.34 per cent) was more stable in the dryland region of Haryana. The yield variability has been found low in wheat (17.76 per cent), cotton (American) (19.78 per cent) and cotton (desi) (21.91 per cent) and high in bajra (43.48 per cent), gram (30.35 per cent) and rapeseed and mustard (26.87 per cent). The yield variability in the Haryana state as a whole has been found high in bajra (38.02 per cent), gram (29.75 per cent) and rapeseed and mustard (26.23 per cent) and low in wheat (17.01 per cent), cotton (American) (19.79 per cent) and cotton (desi) (19.81 per cent). The variability in the production index was explained to the extent of 95 per cent in the case of dryland region and 94 per cent for the as a whole state. The maximum contributions was due to fertilizer consumption, followed by rainfall and number of tractors in dryland region whereas was maximum due to fertilizer consumption, followed by gross irrigated area of the state. The higher production instabilities in coarse cereals, pulses and oilseeds need special attention, for which development of appropriate technology is a potential area for research.

Ahirwar (2006) while addressing the issues concerning growth in area, production, productivity and supply response of soybean in different districts of Malwa plateau in Madhya Pradesh. The secondary data pertaining to area, production, productivity, prices of soybean, area and harvest prices of competitive crop maize and rainfall were collected for the period of 1990-91 to 2002-03. The

results indicated that the growth of soybean productivity was positive in Dhar, Mandsaur, Ratlam, Dewas and Rajgarh districts but it was insignificant expect for Dewas, while in case of area, growth was positive and significant for all the districts of Malwa plateau. The coefficient of lagged area under soybean was having positive and highly significant impact on current area under soybean in Indore, Ujjain, Dewas and Rajgarh districts as well as lagged yield of soybean was found to have positive and highly significant impact on the current area of soybean in Dhar, Mandsaur and Dewas districts.

Kumar and Mittal (2006) reported that sustainability issue of the crop productivity is fast emerging. The post-Green Revolution phase is characterized by high input-use and decelerating total factor productivity growth (TFPG). The agricultural productivity attained during the 1980s has not been sustained during the 1990s and has posed a challenge for the researchers to shift the production function upward by improving the technology index. It calls for an examination of issues related to the trends in the agricultural productivity, particularly with reference to individual crops grown in the major states of India. Temporal and spatial variations of TFPG for major crops of India have also been examined.

Ahirwar *et al* (2007) while examining the compound growth rate of pigeonpea found the–0.17%, 0.031%, and 0.206% of area, production and productivity in India, respectively. The highest and highly significant growth rates of area and production were 4.17 and 5.19percent in Andhra Pradesh. The percent variation in area, production and productivity of pigeonpea were 3.04, 10.84and 10.61 percent, respectively in India. The highest variation in area and production was found for Mizoram state. (72.76% and 92.49%) however the highest productivity variation was noted for Rajasthan (48.72%) the relative change was found negative in area, production and productivity in India during the period under study. The projected area expected to decrease from 35.18 to 33.70 million hectares, while production and productivity is expected to increase from 23.47 to 23.50 mt and 667kg to 696kg hg, respectively in year 2015-16 if all things remain constant. It also indicates that pigeonpea, as a slow growth crop needs

special attention by the researchers for ensuring the livelihood and nutritional security of increasing population.

Malley *et al.* (2007) sustainable development is necessary for sustainable economic growth and social development in Africa. Sustainable agriculture largely depends on how effective natural and environmental resources are managed and utilized; it also depends on the security of continuous access to such resources. This research was aimed to loud into trends in agricultural productivity, examine the persistence of the environmental insecurity, analyse the relationship between the two, and explore their links to the national development policies. The variations observed in total annual production of rice and maize, which are major cereals in the study area. Education of farmers on sustainable use and management of laid resources and pro-poor rural policies in agriculture.

CHAPTER-III
RESEARCH METHODOLOGY

The present chapter deals with the concise description of the data collection and analytical method used in the light of the objectives of the study. The specific methods concern to the analysis of time series data related to area, production and productivity of paddy, soybean, wheat and gram, in order to exhibit production instability in different 9 blocks of Rewa district are dealt in this chapter.

The research methodology has been discussed in detail under the following heads:

1. The study area.
2. Nature, source of data and reporting period.
3. The analytical economic and statistical tools used.

1. The study area:

The present study was conducted in Rewa district of Madhya Pradesh. The Rewa district lies between latitude 24°18' to 25°12' North and longitude 81°20' to 82°20' East and 715 meters from the mean sea level. In North-East and North-West the district is surrounded by Uttar Pradesh, in South-West Satna district and in South-East Sidhi district is situated. This district lies mostly in Kymore Plateau and Satpura hills of agro-climatic zone IV. This district has been divided into nine blocks i.e. Rewa, Raipur, Sirmaur, Mauganj. Hanumana, Naigarhi, Teonthar, Gangev and Java.

The total geographical area of the Rewa district is 628745 hectares. The cultivated area under different crops is 369399 hectares i.e. 79.86 per cent and only 26.51 per cent of the total sown area is irrigated. The average annual rainfall of the district is about 964.1 mm (Deputy Director Agriculture and Statistical Department Rewa, 2006).

2. Nature, source of data and reporting period:

The proposed study is based on secondary data collected from different published and unpublished records of district statistical office of Rewa district. The

data were mainly related to area, production, and productivity of major *Kharif* and *Rabi* crops. The major *Kharif* season crops of the district are paddy and soybean and *Rabi* season crops are wheat and gram. The selected crops accounts for maximum percentage of the gross cropped area of the Rewa district and therefore these crops were selected for variability analysis. The data on net irrigated area, total irrigated area, irrigated rice area, irrigated wheat area, irrigated cereals area, irrigated pulses area, irrigated oilseed area, rice hybrid area and wheat hybrid area were collected from the available records. The required time series data were related to years 1997-98 to 2007-08.

3. The analytical economic and statistical tools:

Analytical tools:

Complete behavior of time series cannot be understood by any single statistical tool, therefore following important statistical measures were used to analyse the data.

(A) Arithmetic mean: -

The mean was worked out by using the time series secondary date, on area production and productivity of soybean.

$$\overline{X} = \frac{1}{n}\sum X$$

(B) Measure of variability:

To measure the extent of variability in area, production and productivity of paddy, wheat, soybean and gram for the selected periods.

$$\text{C.V. (\%)} = \frac{\text{S.D.}}{\overline{X}} \times 100$$

(C) Trend Analysis and growth rate:

To study the growth rates of paddy, wheat, soybean and gram crops in blocks of Rewa district for trend analysis were carried out using least squared method. The following linear regression equation was fitted to area, production and productivity of paddy, wheat, soybean and gram crops for the study period.

Regression equation:

$Y = a \pm bx + E$

Where
Y = Area/ Production/Productivity

a = Constant or intercept value

b = Regression coefficient

x = Time Period

E = Error term with mean zero and constant variance.

Where regression coefficient (b) was worked out as follows: -

$$byx = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$\text{SE of } byx = \sqrt{\frac{\left[\sum xy - \frac{(\sum y)^2}{n}\right] - b^2\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]}{(n-2)\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]}}$$

t = b/SE of b

The intercept value (a) was estimated as following formula

$$a = \tilde{y} - bx$$

The linear growth rates of area, production and productivity of paddy, wheat, soybean and gram has been worked out by fitting the linear function.

Linear growth rate (%) $= b/\tilde{y} \times 100$

b= Trend value

$\tilde{y}$= Average of area/Production/Productivity

The compound growth rates for area, production and productivity of paddy, wheat, soybean and gram was worked out for individual region and for the state as a whole by fitting the following functional from

$$Y = ab^t$$

or, $\log Y = \log a + t \log b$

or, $U = A + Bt$

Where,

Y= Area/Production/Productivity

a= Constant or intercept value

b =Regression coefficient

t = Time variable

U = log Y

A = log a

B = log b

b = 1 + r, with ‘r’ as the compound growth rate

a = antilog (A)

b = antilog (B)

Compound growth rate (%) = [Antilog (B)-1] × 100

The trend value of b for study period was tested for significance using following formula: -

$t = b/SE \text{ of } b$

Where,

b= trend value of study period

SE of b= Standard error of b

Regression analysis:

Since the characters like yield are associated with or dependent on a number of characters, simple correlation coefficients alone are not sufficient in ascertaining the intensity of association between characters and may even be misleading. Studies with partial regression coefficient are very useful in determining such relationship precisely. In the present study regression (partial) coefficients were utilized to determine the influence of independent variables.

Multiple regression is a measure which gives the prediction equation with the help of which the values of dependent variable may be predicted for given value of independent variables.

The square of multiple correlation (R^2) represented the proportion of total variation in dependent variable explained by independent variables in regression equation.

The determinants of yield of soybean and gram crops were estimated my fitting multiple linear equation of the form,

$$Y = a + b1x1 + b2x2 + b3x3$$

where, Y is soybean and gram yield in quintal/hectare; x1 is net irrigated area; x2 is total irrigated area; x3 is oilseed/pulses irrigated area, ‘a’ is constant and bi’s are respective regression coefficients of the independent variables.

The determinants of yield of paddy and wheat were estimated by fitting multiple linear regression equations of the form,

$$Y = a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5$$

where Y is yield in kg/ha; x1 is net irrigated area; x2 is total irrigated area; x3 is rice/wheat irrigated area, x4 is cereals irrigated area and x5 is rice/wheat hybrid area, ‘a’ is constant and bi’s are respective regression coefficients of independent variables.

CHAPTER-IV
RESULTS AND DISCUSSION

The information presented in this chapter refers to the analytical results obtained pertaining to the objectives as stated earlier. This chapter deals with variability and trend in area, production and productivity of selected crops, determinants of yield of selected crops through regression analysis.

4.1. Variability in area, production & productivity:

The data on variability in area, production and productivity of major crops viz. paddy, soybean, wheat and gram is presented in Table 4.1 to 4.4.

4.1.1. Paddy

Paddy is an important crop of the *kharif* season in almost all the blocks of the district. The data on mean value and associated variability is given in Table 4.1. The highest acreage of paddy crop is noted for Hanumama bllock (25.09 th. ha) followed by Teonthar (18.41 th. ha.), Mauganj (15.38 th. ha), Naigarhi (15.18 th ha) and Sirmaur (15.08 th ha) blocks of the district. These five blocks account for about 71 per cent of the total area of paddy in the district.

The low variability in acreage of paddy was noted for Java (6.20%), Teonthar (6.54%), Raipur karchuliyan (8.67%) and Mauganj (9.15%) blocks while it was moderately high for Sirmaur (12.78%) block of the district.

The data on average production of paddy in different blocks of the districts shows that it was highest in Hanumana block (50.21 thousands tonnes) followed by Teonthar block (36.36 thousands tonnes), Naigarhi (31.61 thousands tonnes), Mauganj (30.44 thousands tonnes), Sirmaur (29.57 thousands tonnes) and Gangev (25.07 thousands tonnes). These six blocks account for more than 81 per cent of the total production of paddy in the district. Production variability in all the blocks of the district was higher as compared to acreage and productivity variability. The production variability is a product of acreage and productivity variability. The variability in production ranged between 15.17 per cent for Java block to 23.61 per cent for Gangev block of Rewa district.

The mean productivity data of paddy is presented in Table 4.1 revealed that it ranged between 18.99 q/ha to 20.02 q/ha with the variability in the range of 13.00 per cent to 17.21 per cent and it is also observed that, in general, the blocks with lower acreage variability have higher productivity variability and vice-versa, which ultimately resulted in higher production variability of paddy in different blocks.

Table 4.1: Extent of variability in area, production and productivity of paddy crop in different blocks of Rewa district

Blocks	Area		Production		Productivity	
	Mean	CV%	Mean	CV%	Mean	CV%
Rewa	7244	13.97	141431	17.44	19.57	14.67
Raipur karchuliyan	6491	8.67	123535	19.44	18.99	17.21
Sirmaur	15077	12.78	295683	21.51	19.44	13.00
Gangev	12722	10.46	250657	23.61	19.45	16.44
Java	10203	6.20	198155	15.17	19.44	14.37
Mauganj	15383	9.15	304376	19.28	19.69	13.97
Naigarhi	15179	11.78	316138	20.68	20.02	14.05
Hanumana	25093	10.48	502096	21.56	19.80	13.84
Teonthar	18406	6.54	363590	20.05	19.61	14.76
Rewa District	125798	7.49	2495662	19.03	19.70	13.76

4.1.2. Soybean

Soybean is also an important crop of the *kharif* season of the district but due to irregular rains and introduction of hybrid rice in the area, its area is decrease during last decade. The data on variability in area, production and productivity of soybean in different blocks of the district is given in table 4.2. The data clearly indicates that due to reduction in area the variability in area was high in almost all the blocks. It ranges from 15.28 to 116.62 percent in different blocks of the district. Presently this crop is grown in an area of 16.61 thousand hectare in

the district. The regression coefficient value for area was calculated –1029.14 indicating drastic reduction in acreage of soybean in the district. On the basis of mean data Rewa Block was the main soybean growing area accounts for 6.50 thousand hectare followed by Sirmaur (3.86 thousand hectare) and Raipur karchuliyan (3.20 thousand hectare) blocks.

Table 4.2: Extent of variability in area, production and productivity of soybean crop in different blocks of Rewa district

Blocks	Area		Production		Productivity	
	Mean	CV%	Mean	CV%	Mean	CV%
Rewa	6503	30.21	106696	21.27	16.79	13.34
Raipur karchuliyan	3195	15.28	50457	23.75	15.75	13.37
Sirmaur	3860	41.96	60749	28.37	16.46	15.28
Gangev	1918	36.76	30697	29.81	16.25	13.34
Java	21	53.07	338	48.37	16.34	13.41
Mauganj	565	116.62	8320	102.95	16.41	10.84
Naigarhi	414	68.02	6300	55.57	16.16	12.42
Hanumana	51	54.67	763	51.63	16.12	13.91
Teonthar	88	100.66	1287	86.80	16.08	13.29
Rewa District	16615	31.95	265608	21.70	16.42	13.22

The mean of production of soybean in the district was 26.56 thousand tonnes with high variability mainly due to high acreage variability followed by lower to moderate productivity variability. The production variability was as high as 102.95 per cent in Mauganj block and it is least but still high in Rewa block (21.27%). The average productivity of the soybean in the district was 16.42 q/ha, which was highest in Rewa block (16.79 q/ha) and lowest (15.75 q/ha) in Raipur karchuliyan block. The variability in productivity was lower as compared to area and production variability in all blocks of the district. Thus, it is revealed that high variability in production of soybean is mainly due to high acreage variability rather than productivity variability.

4.1.3. Wheat

Wheat is an important crop of the district grown during rabi season under irrigated, semi-irrigated and rainfed conditions. The data on average area, production and productivity and associated variability of wheat in different blocks of Rewa district is given in Table 4.3.

The data presented in above referred table revealed that the average acreage of wheat in the district was 122.53 thousand hectare during the period of 1997-98 to 2007-08 with considerably high variability (31.94%). The highest acreage of wheat is confined to Sirmaur (20.67 thousand hectare), followed by Rewa (17.85 th ha), Teonthar (16.72 th ha), Gangev (14.98 th ha) and Hanumana (13.66 th ha) blocks. The variability in acreage of wheat ranged to the tune of 13.20 to 47.68 per cent in different blocks of the district.

The average production of wheat was 197.46 thousand tonnes in the district with variability of 39.34 per cent. The highest production of wheat is confined to Sirmaur (32.85 thousand tonnes), followed by Rewa (28.55 thousand tonnes),Teonthar (27.76 thousand tonnes), Gangev (24.14 thousand tonnes) and Hanumana (22.24 thousand tonnes) blocks. The moderately high variability in production of wheat as compared to variability in its acreage and productivity was mainly due to interactive action of variability of both area and productivity. The variability in production of wheat ranged to the tune of 28.29 to 58.54 percent in different blocks.

The average productivity of wheat was 16.14 q/ha in the district. The block wise productivity was ranged between 16.04 to 16.56 q/ha. This revealed that wheat crop in different blocks is mostly confined to rained condition; therefore the productivity of wheat depends on monsoon rains. The variability in productivity of wheat for the district was 19.27 per cent and block wise it ranged to the tune of 15.63 to 20.36 per cent in Sirmaur and Raipur karchuliyan block of the district, respectively.

Table 4.3: Extent of variability in area, production and productivity of wheat crop in different blocks of Rewa district

Blocks	Area		Production		Productivity	
	Mean	CV%	Mean	CV%	Mean	CV%
Rewa	17851	25.16	285507	32.87	16.05	20.19
Raipur karchuliyan	8931	42.78	144203	49.22	16.18	20.36
Sirmaur	20671	35.19	328548	37.10	16.04	15.63
Gangev	14976	44.83	241370	51.07	16.19	18.60
Java	9862	13.30	158853	22.92	16.25	19.65
Mauganj	10940	39.04	168713	58.54	16.42	16.96
Naigarhi	8921	47.68	147448	55.04	16.42	16.21
Hanumana	13665	34.85	222428	45.16	16.12	19.91
Teonthar	16716	17.90	277574	28.29	16.56	18.93
Rewa District	122533	31.94	1974644	39.34	16.14	19.27

4.1.4. Gram

Gram is second important crop cultivated in *rabi* season in the district. The data on average area, production and productivity and associated variability of this crop is given in Table 4.4.

The data revealed that the crop is cultivated in an area of 60.16 thousand hectare in the district. The highest acreage under this crop is confined to Teonthar block (10.88 th ha) followed by Sirmaur (8.13 th ha) and Gangev (8.02 th ha) block whereas low acreage is observed in Mauganj (4.49 thousand hectare). At district level, variability in its acreage was 10.51 per cent. The block wise data on variability in area shows that it was highest (27.26%) in Java block and lowest (3.52%) in Raipur karchuliyan block.

The production of this crop was about 95 thousands tonnes in the district with variability of 14.09 per cent. The highest production of gram is confined to Teonthar (17.17 thousands tonnes), followed by Sirmaur (12.77 thousands tonnes) and Gangev (12.60 thousands tonnes) blocks. The maximum variability in

production was reported in Java block (32.04%) and minimum in Naigarhi block (9.94%). Over all the variability in production was higher as compared to area in most of the blocks. The productivity of gram in the district was about 16 q/ha with highest productivity of 16.19 q/ha in Rewa block. The variability in productivity was reported highest in Gangev block and lowest in Naigarhi block.

Table 4.4: Extent of variability in area, production and productivity of gram crop in different blocks of Rewa district

Blocks	Area		Production		Productivity	
	Mean	CV%	Mean	CV%	Mean	CV%
Rewa	6766	7.26	109791	16.04	16.19	16.30
Raipur karchuliyan	5166	3.52	81673	13.88	15.85	15.09
Sirmaur	8130	9.08	127683	21.44	15.64	17.20
Gangev	8018	7.70	126017	16.32	15.61	18.67
Java	6611	27.26	104028	32.04	15.96	17.61
Mauganj	4490	24.58	71075	20.11	16.17	15.63
Naigarhi	4558	16.55	71514	9.94	15.97	14.21
Hanumana	5539	11.50	85462	10.18	15.69	18.39
Teonthar	10878	27.13	171712	28.61	15.89	17.53
Rewa District	60158	10.51	948956	14.09	15.91	16.12

4.2 Growth in area, production and productivity:

The block wise growth (linear and compound) rates of area, production and productivity of paddy, paddy, wheat and gram were estimated from the time-series (secondary) data collected from the Commissioner of Land Record in Gwalior and these estimates are presented in Table 4.5. to 4.16.

4.2.1 Paddy:

4.2.1.1 Growth in area:

The data on trend value (b) linear as well as compound growth rate (CGR) in area of paddy for different blocks of Rewa District are given in Table 4.5. It is observed from the Table 4.5 that there is a positive and significant growth in area of paddy in Sirmaur, Hanumana and Teonthar blocks during the study period (1997-98 to 2007-08). The trend analysis indicates that against the overall linear growth rate of 1.629 per cent in area of paddy, the block like Sirmaur showed highest linear growth rate of 2.462 per cent followed by Naigarhi (2.457%), Hanumana (2.418%) and Gangev (2.308%)

Table 4.5 reveals that compound growth rate of paddy area was also highest in Sirmaur (2.75%) followed by Hanumana (2.66%), Naigarhi (2.49%), and Gangev (2.47%), whereas it was negative in Rewa (-0.42%) and Java (-0.41). All the blocks taken together i.e. Rewa district had registered compound growth rate of 1.72 per cent for paddy area.

It is thus concluded from the above findings that the area of paddy showed highest positive linear as well as compound growth rate in Sirmaur Valley, while negative growth (linear as well as compound) rate was recorded in Rewa and Java during the study period. In addition to this the above discussion also reveal that relatively major paddy growing blocks like Teonthar and Hanumana showed considerably low growth of area.

Table 4.5: Growth in area of paddy in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	-45.936	0.46	-0.634	-0.42
2	Raipur karchuliyan	27.218	0.49	0.419	0.48
3	Sirmaur	371.1545	2.49*	2.462	2.75
4	Gangev	293.6	3.22*	2.308	2.47
5	Java	-40.482	0.65	-0.397	-0.41
6	Mauganj	156.445	1.19	1.017	1
7	Naigarhi	372.973	2.88	2.457	2.49
8	Hanumana	606.7	3.56**	2.418	2.66
9	Teonthar	294.791	4.18**	1.602	1.65
	Rewa District	**2036.464**	**3.09**	**1.619**	**1.72**

*- Significant at p=0.05 **- Significant at p=0.01

4.2.1.2 Growth in production:

The data on trend value (b) linear as well as compound growth rate in production of paddy for different blocks are presented in Table 4.6. It observed from the table that there is a positive and significant growth in production of paddy in all the blocks of Rewa.

The blocks viz., Gangev (6.856%), Hanumana (6.195%), Sirmaur (5.932%)and Teonthar (5.866%) have shown considerably higher linear growth rate against the overall linear growth rate of 5.514 per cent in production of paddy in Rewa district. Table 4.6 further reveals that compound growth rate of paddy production was also higher in Gangev block (7.65%) followed by Hanumana block (7.04%), Sirmaur block (6.78%) and Teonthar block (6.31%) than overall compound growth rate of 6.07 per cent in paddy production of Rewa district.

Table 4.6: Growth in production of paddy in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	4956.99	2.68*	3.505	4.16
2	Raipur karchuliyan	6602.391	6.67**	5.345	5.95
3	Sirmaur	17541.34	6.78**	5.932	6.78
4	Gangev	17184.11	10.70**	6.856	7.65
5	Java	7476.127	4.38**	3.773	4.02
6	Mauganj	15247.78	5.09**	5.010	5.41
7	Naigarhi	16180.8	4.31**	5.118	5.5
8	Hanumana	31106.29	9.44**	6.195	7.04
9	Teonthar	21326.49	12.03**	5.866	6.31
	Rewa District	**137622.3**	**10.45****	**5.514**	**6.07**

*- Significant at p=0.05 **- Significant at p=0.01

4.2.1.3 Growth in productivity:

The data on trend value (b), linear as well as compound growth rate of average productivity of paddy in different blocks and Rewa district as a whole are given in Table 4.7. As observed from the table that the trend value (b) in all the blocks of Rewa district and also in Rewa as a whole is positive and highly significant. The overall average productivity of paddy has increased by 81.10 kg/ha per year. The linear as well as compound growth rate of paddy productivity was highest in Raipur karchuliyan block (5.166 and 5.42%) followed by Gangev block (4.936% and 5.14%), Rewa block (4.41% and 4.59%), Teonthar block (4.406 and 4.58%), Java block (4.218 and 4.45%), Naigarhi block (4.186 and 4.36%) and Mauganj (4.159 and 4.37%). All the blocks taken together had registered 4.117 and 4.28 per cent linear and compound growth rates in productivity of paddy, respectively.

Table 4.7: Growth in productivity of paddy in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	0.863	35.99**	4.410	4.59
2	Raipur karchuliyan	0.981	30.73**	5.166	5.42
3	Sirmaur	0.745	13.74**	3.832	3.93
4	Gangev	0.96	32.74**	4.936	5.14
5	Java	0.82	12.83**	4.218	4.45
6	Mauganj	0.819	18.95**	4.159	4.37
7	Naigarhi	0.838	19.36**	4.186	4.37
8	Hanumana	0.812	15.77**	4.101	4.27
9	Teonthar	0.864	20.46**	4.406	4.58
	Rewa District	**0.811**	**23.94****	**4.117**	**4.28**

**- Significant at p=0.01

Growth in yield is more important than that of area and production because it serve as a barometer to gauge the technical development of a crop over a period. The foregoing discussion reveals that growth rates of area and production of paddy were not only considerably high in Sirmaur, Naigarhi, Hanumana and Gangev blocks but also its overall growth rates of production were as high as 6.07 per cent. The position was poor in respect of its block wise and overall productivity, it is pertinent to note that on the one hand the current higher prices of paddy might have given boost to its area and production, whereas a shortage of different crucial inputs and non adoption of modern techniques of farming might be some of the reasons for poor yield of paddy on the other hand.

Since paddy crop is predominantly rainfed crop, therefore, sufficient and timely rainfall is an essential pre-requisite for a good harvest.

4.2.2 Soybean:

4.2.2.1 Growth in area:

The data on trend value (b) linear as well as compound growth rate (CGR) in area of soybean for different blocks of Rewa District are given in Table 4.8. It is observed from the Table 4.8 that there is a negative growth in area of soybean in all the blocks except Raipur karchuliyan. Out of 9 blocks, 6 blocks viz., Sirmaur, Gangev, Mauganj, Naigarhi, Hanumana and Teonthar showed negative and significant growth in area. The trend analysis indicates that the block like Mauganj showed highest linear growth rate of –29.038 per cent followed by Teonthar (-21.555%), Naigarhi (-16.39%) and Hanumana (-11.656%) against the overall linear growth rate of –6.194 per cent in area of soybean.

Table 4.8 reveals that compound growth rate of soybean area was also negative in most of the blocks including district as a whole and it was highest in Mauganj (-25.76%) followed by Teonthar (-16.69%), Naigarhi (-14.78%) and Hanumana (-13.58%), where it was positive in only Raipur karchuliyan (1.17%). All the blocks taken together i.e. Rewa district had registered compound growth rate of –5.09 per cent for soybean area.

It is thus concluded from the above findings that the area of soybean showed negative linear as well as compound growth rate in most of the blocks along with district and it was highest in Mauganj followed by Teonthar blocks, while positive but non-significant growth (linear as well as compound) rate was recorded in Raipur karchuliyan. In addition to this the above discussion also reveal that relatively major soybean growing blocks like Rewa, Sirmaur and Gangev showed considerably very low and negative growth of area.

Table 4.8: Growth in area of soybean in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	-330.83	2.02	-5.088	-4.04
2	Raipur karchuliyan	41.027	0.87	1.284	1.17
3	Sirmaur	-339.95	2.91*	-8.807	-7.21
4	Gangev	-141.164	2.66*	-7.359	-5.98
5	Java	-1.509	1.49	-7.125	-5.95
6	Mauganj	-164.136	4.39**	-29.028	-25.76
7	Naigarhi	-67.782	3.99**	-16.390	-14.78
8	Hanumana	-5.955	3.00*	-11.656	-13.56
9	Teonthar	-18.836	3.02*	-21.515	-16.69
	Rewa District	**-1029.14**	**2.52***	**-6.194**	**-5.09**

*- Significant at p=0.05 **- Significant at p=0.01

4.2.2.2 Growth in production:

The data on trend value (b) linear as well as compound growth rate in production of soybean for different blocks are presented in Table 4.9. It observed from the table that there is a negative and significant growth in production of soybean in Mauganj, Naigarhi and Teonthar while positively significant in Raipur karchuliyan block.

The blocks viz., Mauganj, Teonthar, Naigarhi and Hanumana exhibited higher linear growth rate in negative direction as compared to other blocks and showing –26.23, -17.63, -12.42 and –8.89 per cent growth rate, respectively against the overall linear growth rate of –1.44 per cent in production of soyabean in Rewa district. Table 4.9 further revealed that compound growth rate of soybean production in most of the blocks as well as districts was also negative and was higher in Mauganj block (-23.37%) followed by Teonthar block (-13.38%), Naigarhi (-11.81%) and Hanumana block (-10.64%) than overall compound growth rate of –1.19 per cent in soybean production of Rewa district.

Table 4.9: Growth in production of soybean in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	-353.5	0.15	-0.331	-0.06
2	Raipur karchuliyan	2872.882	3.93**	5.694	5.32
3	Sirmaur	-2066.43	1.30	-3.402	-2.83
4	Gangev	-1019.16	1.19	-3.320	-2.53
5	Java	-5.895	0.36	-1.742	-2.19
6	Mauganj	-2182.14	4.74**	-26.227	-23.37
7	Naigarhi	-782.8	3.31**	-12.425	-11.81
8	Hanumana	-67.86	2.09	-8.893	-10.64
9	Teonthar	-226.927	2.74*	-17.633	-13.38
	Rewa District	**-3831.83**	**0.68**	**-1.443**	**-1.19**

*- Significant at p=0.05 **- Significant at p=0.01

4.2.2.3 Growth in productivity:

The data on trend value (b), linear as well as compound growth rate of average productivity of soybean in different blocks and Rewa district as a whole are given in Table 4.10. As observed from the table that the trend value (b) in all the blocks of Rewa district and also in Rewa as a whole is positive and highly significant. The overall average productivity of soybean has increased by 65.20 kg/ha per year. The linear as well as compound growth rate of soybean productivity was highest in Sirmaur block (4.526 and 4.73%) followed by Hanumana block (4.045% and 4.16%), Rewa block (3..985% and 4.15%), Java block (3.935 and 4.10%) and Raipur karchuliyan block (3.911 and 4.00%). All the blocks taken together had registered 3.971 and 4.12 per cent linear and compound growth rates in productivity of soybean, respectively.

The foregoing discussion reveals that growth rates of area and production of soybean were negative in most of the blocks but was positive and highly significant in case of productivity for all the blocks as well as district. The above analysis clearly indicates that in Rewa district that soyabean crop is vanishing from the cropping pattern due to irregular rains and introduction of hybrid rice.

Table 4.10: Growth in productivity of soybean in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	0.669	21.44**	3.985	4.15
2	Raipur karchuliyan	0.616	12.16**	3.911	4.00
3	Sirmaur	0.745	15.36**	4.526	4.73
4	Gangev	0.634	11.78**	3.902	3.94
5	Java	0.643	12.63**	3.935	4.10
6	Mauganj	0.508	8.88**	3.096	3.23
7	Naigarhi	0.551	6.59**	3.410	3.49
8	Hanumana	0.652	10.87**	4.045	4.16
9	Teonthar	0.615	9.53**	3.825	3.94
	Rewa District	**0.652**	**32.83****	**3.971**	**4.12**

**- Significant at p=0.01

4.2.3 Wheat:

The trend coefficient (b) for area under wheat was found to be positive for Gangev, Mauganj, Naigarhi, Hanumana and Teonthar including district and negative for Rewa, Raipur karchuliyan, Sirmaur and Java, but none of the 'b' values were found significant (Table 4.11). However, the per cent growth rate in acreage of wheat was maximum for Hanumana block (1.67) followed by Naigarhi block (1.35%).

It is interesting to note that the trend coefficient for production of wheat was positive for all blocks despite of negative trend in acreage of Rewa, Raipur karchuliyan, Sirmaur and Java blocks (Table 4.12). The per cent linear growth rate was positive and highest for Mauganj (11.19%), followed by Hanumana (8.49%), Gangev (7.58%), Naigarhi (7.43%) and Raipur karchuliyan (7.12%). The trend coefficient for wheat production was positive for all blocks and it was highly significant for Java and Teonthar blocks and significant for Rewa, Mauganj and Hanumana blocks of the district.

Table 4.12 further revealed that compound growth rate of wheat was also positive for all the blocks and district and was highest for Rewa block (16.94%) and lowest for Sirmaur block (4.27%). The overall compound growth rate of wheat production was 6.34 per cent.

Table 4.11: Growth in area of wheat in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	-119.936	0.27	-0.672	-0.67
2	Raipur karchuliyan	-27.846	0.07	-0.312	-0.26
3	Sirmaur	-128.818	0.18	-0.623	-0.45
4	Gangev	138.054	0.21	0.922	0.56
5	Java	-6.955	0.05	-0.071	-0.06
6	Mauganj	107.245	0.25	0.980	0.22
7	Naigarhi	120.727	0.28	1.353	0.24
8	Hanumana	228.591	0.48	1.673	1.38
9	Teonthar	99.536	0.33	0.595	0.57
	Rewa District	**410.6**	**0.10**	**0.335**	**0.21**

Table 4.12: Growth in production of wheat in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	17864.32	2.44*	6.257	5.67
2	Raipur karchuliyan	10342.86	1.66	7.172	6.09
3	Sirmaur	15495.31	1.32	4.716	4.27
4	Gangev	18286.71	1.70	7.576	6.2
5	Java	9181.45	4.58**	5.780	5.73
6	Mauganj	18878.4	2.46*	11.190	16.94
7	Naigarhi	10948.83	1.50	7.426	5.35
8	Hanumana	18892.89	2.39*	8.494	7.67
9	Teonthar	18348.88	3.68**	6.610	6.67
	Rewa District	**138239.6**	**2.19**	**7.001**	**6.34**

*- Significant at p=0.05 **- Significant at p=0.01

The data on trend value (b), linear as well as compound growth rate of average productivity of wheat in different blocks and Rewa district as a whole are given in Table 4.13. As observed from the table that the trend value (b) in all the blocks of Rewa district and also in Rewa as a whole is positive and highly significant. The overall average productivity of wheat has increased by 92.80 kg/ha per year. The linear growth rate of wheat productivity was highest in Raipur karchuliyan block (6.082%) followed by Rewa block (6.081%), Hanumana block (5.943%), Java block (5.852%) and Teonthar block (5.670%). The compound growth rate of the wheat productivity also showed more or less similar trend as observed in linear growth rate. All the blocks taken together had registered 5.75 and 6.12 per cent linear and compound growth rates in productivity of wheat, respectively.

On the basis of the results pertaining to linear as well as compound growth rate of wheat crop. It can be concluded that despite of reduction in acreage of four blocks of Rewa district namely Rewa, Raipur karchuliyan, Sirmaur and Java, the production as well as productivity was found in increasing trend in all blocks of Rewa district and as a whole.

Table 4.13: Growth in productivity of wheat in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	0.976	75.44**	6.081	6.93
2	Raipur karchuliyan	0.984	21.42**	6.082	6.38
3	Sirmaur	0.735	12.40**	4.582	4.77
4	Gangev	0.864	9.24**	5.240	5.61
5	Java	0.951	18.77**	5.852	6.05
6	Mauganj	0.832	22.24**	5.067	5.22
7	Naigarhi	0.793	18.96**	4.829	5.09
8	Hanumana	0.958	21.51**	5.943	6.21
9	Teonthar	0.939	25.74**	5.670	6.06
	Rewa District	**0.928**	**20.44****	**5.750**	**6.12**

**- Significant at p=0.01

4.2.4 Gram:

4.2.4.1 Growth in area:

The data on trend value (b) linear as well as compound growth rate (CGR) in area of gram for different blocks of Rewa District are given in Table 4.14. . It is observed from the Table 4.14 that there is a negative growth in area of gram in all the blocks except Sirmaur. Out of 9 blocks, 4 blocks viz., Raipur karchuliyan, Mauganj, Naigarhi and Hanumana showed negative and significant growth in area. The trend analysis indicates that the block like Mauganj showed highest linear growth rate of –5.048 per cent followed by Naigarhi (-3.828%), Hanumana (-3.047%) and Teonthar (-3.014%) against the overall linear growth rate of –1.838 per cent in area of gram.

Table 4.14: Growth in area of gram in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	-28.955	0.60	-0.428	-0.4
2	Raipur karchuliyan	-35.573	2.55**	-0.689	-0.69
3	Sirmaur	79.464	1.15	0.977	0.93
4	Gangev	-60.491	1.03	-0.754	-0.69
5	Java	-162.636	0.94	-2.460	-4.72
6	Mauganj	-226.645	2.79*	-5.048	-5.01
7	Naigarhi	-174.5	3.59**	-3.828	-3.82
8	Hanumana	-168.755	5.52**	-3.047	-3
9	Teonthar	-327.864	1.19	-3.014	-5.59
	Rewa District	**-1105.95**	**2.14**	**-1.838**	**-1.97**

*- Significant at p=0.05 **- Significant at p=0.01

Table 4.14 reveals that compound growth rate of gram area was also negative in all the blocks including district as a whole (except Sirmaur) and it was highest in Teonthar (-5.59%) followed by Mauganj (-5.01%), Java (-4.72%) and Naigarhi (-3.82%), where it was positive in only Sirmaur (0.93%). All the blocks

taken together i.e. Rewa district had registered compound growth rate of –1.97 per cent for gram area.

It is thus concluded from the above findings that the area of gram showed negative linear as well as compound growth rate in most of the blocks along with district and it was highest in Mauganj followed by Teonthar blocks, while positive but non-significant growth (linear as well as compound) rate was recorded in Sirmaur.

4.2.4.2 Growth in production:

The data on trend value (b) linear as well as compound growth rate in production of gram for different blocks are presented in Table 4.15. It observed from the table that there is a positive growth in production of gram in all the blocks (except Mauganj) of Rewa district but significant in Rewa, Raipur karchuliyan, Sirmaur, Gangev and Hanumana blocks.

The linear as well as compound growth rate of gram production was highest in Sirmaur block (5.872 and 6.39%) followed by Gangev block (4.579% and 4.78%), Rewa block (4.038% and 4.50%) and Raipur karchuliyan block (3.607 and 3.85%). All the blocks taken together had registered 2.89 and 2.89 per cent linear and compound growth rates in production of gram, respectively.

4.2.4.3 Growth in productivity:

The data on trend value (b), linear as well as compound growth rate of average productivity of gram in different blocks and Rewa district as a whole are given in Table 4.16. As observed from the table that the trend value (b) in all the blocks of Rewa district and also in Rewa as a whole is positive and highly significant. The overall average productivity of gram has increased by 77.10 kg/ha per year. The linear growth rate ranged from 4.164 to 5.507 per cent. Hanumana and Naigarhi showed the highest and lowest linear growth rate, respectively. Like linear growth rate, compound growth rate also exhibited similar trend as Hanumana and Naigarhi showed the highest and lowest compound growth rate value being 5.75 and 4.32 per cent, respectively.

On the basis of the results pertaining to linear as well as compound growth rate of gram crop, it can be concluded that despite of reduction in acreage of most of the blocks, the production as well as productivity was found in increasing trend in almost all blocks of Rewa district and as a whole.

Table 4.15: Growth in production of gram in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	4433.00	4.55**	4.038	4.5
2	Raipur karchuliyan	2946.095	5.09**	3.607	3.85
3	Sirmaur	7497.223	6.51**	5.872	6.39
4	Gangev	5770.358	7.63**	4.579	4.78
5	Java	2339.507	0.72	2.249	0.42
6	Mauganj	-387.109	0.27	-0.545	-0.38
7	Naigarhi	293.738	0.42	0.411	0.33
8	Hanumana	2134.664	4.20**	2.498	2.58
9	Teonthar	2401.582	0.49	1.399	-0.63
	Rewa District	**27429.06**	**2.78***	**2.890**	**2.98**

*- Significant at p=0.05 **- Significant at p=0.01

Table 4.16: Growth in productivity of gram in different blocks of Rewa for the period of 1997-98 to 2007-08.

Blocks		'b' value	't' value	Linear growth rate (%)	Compound growth rate (%)
1	Rewa	0.781	15.45**	4.824	5.04
2	Raipur karchuliyan	0.679	8.43**	4.284	4.57
3	Sirmaur	0.803	21.01**	5.134	5.41
4	Gangev	0.845	10.63**	5.413	5.64
5	Java	0.827	13.42**	5.182	5.39
6	Mauganj	0.755	20.87**	4.669	4.88
7	Naigarhi	0.665	12.23**	4.164	4.32
8	Hanumana	0.864	24.17**	5.507	5.75
9	Teonthar	0.805	10.12**	5.066	5.21
	Rewa District	**0.771**	**34.26****	**4.846**	**5.06**

**- Significant at p=0.01

4.3 Regression analysis:

The yield of a crop is dependent on a number of variables and simple correlation coefficients alone are not enough for obtaining the intensity of association between variables and may even be misleading sometimes. Studies with partial regression coefficients are very useful statistical tool in determining such relationship precisely.

4.3.1 Determinants of yield:

4.3.1.1 Paddy:

In order to study the influence of five variables on yield of paddy, the values of partial regression coefficients (b-values) were worked out and results are presented in Table 4.17. Table 4.17 shows none of the variables emerged as the most important factors in determining yield variation for paddy at district level. However, at block levels, net irrigated area and cereals irrigated area for Rewa block and total irrigated area for Java block exhibited positive and highly significant influence on yield of paddy, while net irrigated area and rice irrigated area showed negative and significant influence on yield of paddy.

On the basis of coefficient of determination (R^2) it can be observed from the Table 4.17 that about 94.93, 86.96, 69.10, 82.24, 94.91, 80.01, 83.18, 72.97, 82.38 and 67.64 per cent of variation in paddy productivity were contributed by all the five variables in Rewa, Raipur karchuliyan, Sirmaur, Gangev, Java, Mauganj, Naigarhi, Hanumana and Teonthar and at district level, respectively.

Multiple regression equations fitted to serve as selection indices were judge by R^2, the square of the multiple correlation coefficient (i.e. coefficient of determination) and it was found that the multiple regression equation based on net irrigated area, total irrigated area and cereals irrigated area may be appeared to be fairly effective selection index for determining the paddy yield at district level and also for some of the blocks. Therefore, any crop planning in this regard should follow above observations to obtain higher returns and minimum risk in the productivity of paddy.

Table 4.17: Regression coefficient of paddy yield on five independent variables

Blocks	Constant	Regression coefficient					R^2
		X1	X2	X3	X4	X5	
Rewa	-24.6277	0.0067**	-0.004	-0.0013	0.0008**	0.00064	0.9493
Raipur karchuliyan	22.9601	0.0022	-0.00032	0.0017	-0.0024	-0.0065	0.8696
Sirmaur	22.4455	0.00276	-0.0023	-0.0003	-0.0006	-0.0012	0.6910
Gangev	56.0107	-0.0010	-0.0021	-0.0012	-0.0017	0.0256	0.8224
Java	-3.7559	-0.00005*	0.0029**	-0.0013*	0.00008	-0.0009	0.9491
Mauganj	66.2089	0.00001	-0.0084	0.00014	-0.0003	-0.0014	0.8001
Naigarhi	41.9407	0.0022	-0.0064	-0.0005	-0.0002	-0.029	0.8318
Hanumana	21.6371	0.00043	0.0002	-0.00032	-0.0006	-0.0160	0.7297
Teonthar	-10.1102	0.00093	0.00089	0.0014	-0.0003	-0.0005	0.8238
Rewa District	**-16.975**	**0.000012**	**0.0004**	**-0.00014**	**0.00003**	**0.0004**	**0.6764**

X1 = Net Irrigated area, X2 = Total irrigated area, X3 = Rice irrigated area X4= Cereals irrigated area, X5= Rice Hybrid area
*- Significant at p=0.05, **- Significant at p=0.01

4.3.1.2 Determinants of yield of soybean:

There is very high multicollinearity among various variables hypothesised to effect yield. In order to identify which variables out of those having significant correlation with yield actually affect the yield, the values of partial regression coefficients were worked out and results are presented in Table 4.18. Among all variables, taken for the present study. It is observed from Table 4.18 that soybean yield was positively and significantly influenced by total irrigated area in Java block. Soybean yield also positively and significantly influenced by net irrigated area and oilseed irrigated area in Teonthar block. However, total irrigated area and oilseed irrigated area negatively and significantly influenced the soybean yield in Gangev and Java blocks, respectively.

The multiple R^2 (coefficient of determination) value had been found 32.17 per cent at district level to imply that all variables put together only 32.17 per cent of total variation had been rendered explicable. The multiple R^2 value at district level indicates that some other variables like rainfall during crop season, fertilizer consumption etc. also had substantial effect on the yield of soybean. Table 4.18 further indicated that 48.11 to 88.05 per cent variation in yield contributed by all three variables included in the study in regards to blocks.

Thus, on the basis of above findings it can be concluded that none of the studied variables emerged undisputedly as the most important factor in determining yield variation because none of these had influence on soybean yield at district level.

Table 4.18: Regression coefficient of soybean yield on three independent variables

Blocks	Constant	Regression coefficient			R^2
		X1	X2	X3	
Rewa	-9.3619	0.01008	-0.0074	-0.0946	0.5424
Raipur karchuliyan	20.0983	-0.0088	0.0057	0.0533	0.7034
Sirmaur	16.4948	0.0041	-0.0039	-0.0212	0.4921
Gangev	24.8049	-0.00076	0.000035	-0.0725*	0.6713
Java	-8.5929	-0.000028	0.0027**	0.0056	0.8115
Mauganj	51.4801	-0.0014	-0.0049*	-0.0144	0.8805
Naigarhi	31.8153	-0.0042	0.0010	-0.0334	0.7745
Hanumana	-8.6182	0.0021	0.000006	0.01518	0.4811
Teonthar	-0.4144	0.0013*	-0.0002	0.0588**	0.8343
Rewa District	**-12.6648**	**-0.000005**	**0.00038**	**-0.0039**	**0.3217**

X1 = Net Irrigated area, X2 = Total irrigated area, X3 = Oilseed irrigated area
*- Significant at p=0.05. **- Significant at p=0.01

4.3.1.3 Determinants of yield of wheat:

It was found from the Table 4.19 that wheat irrigated area had recorded a significant 't' value for their partial regression coefficient in Teonthar block and at district level to imply that this had got substantive effect in determining the yield of wheat.

The multiple R^2 had been found 70.97 at district level to imply that all five variables put together 70.96 per cent of total variation had been rendered explicable. Table further indicated that 67.412 to 95.09 variation in yield contributed by all five variables included in the study. Thus, it may be concluded that the multiple regression equation based on wheat irrigated area may be appeared to be effective selection index for determining the wheat yield.

Table 4.19: Regression coefficient of wheat yield on five independent variables

Blocks	Constant	Regression coefficient					R^2
		X1	X2	X3	X4	X5	
Rewa	-25.9626	0.00466	-0.0023	0.0012	-0.00018	-	0.9509
Raipur karchuliyan	22.0459	-0.0010	0.00013	0.00047	-0.00086	-0.0013	0.7920
Sirmaur	4.1107	0.0039	-0.0034	0.0017	-0.0013	0.0007	0.6741
Gangev	55.033	-0.00005	-0.0028	-0.0004	-0.0014	0.0004	0.7076
Java	-14.2776	-0.000002	0.0031	0.00014	0.00005	0.0002	0.8736
Mauganj	56.3187	-0.0032	-0.0043	0.00016	-0.00013	0.00018	0.6756
Naigarhi	51.3709	-0.0041	-0.0024	-0.0009	-0.0002	-0.0004	0.8391
Hanumana	-23.8002	0.0051	0.00058	0.00046	-0.00005	-0.0025	0.7351
Teonthar	0.2609	0.00007	0.00041	0.00075*	0.00002	0.00002	0.8765
Rewa District	**-48.3855**	**-0.000002**	**0.00064**	**0.00017***	**0.00003**	**-0.00002**	**0.7096**

X1 = Net Irrigated area, X2 = Total irrigated area, X3 = Wheat irrigated area
X4= Cereals irrigated area, X5= Wheat Hybrid area
*- Significant at p=0.05

4.3.1.2 Determinants of yield of gram:

Table 4.20 presents regression analysis of yield of gram on three independent variables. Table 4.20 indicated that only total irrigated area was positively and significantly influencing the yield of gram in Java block. The other variables viz., pulse irrigated area had negative impact on yield of gram in Raipur karchuliyan and Sirmaur blocks. The variables like net and total irrigated area had positive influence on yield of gram at district level but not high enough to be statistically significant.

The multiple R^2 being 55.57 per cent at district level, the inferences could be drawn that these variables had explained slightly more than 50% amount of total variation.

Table 4.20: Regression coefficient of gram yield on three independent variables

Blocks	Constant	Regression coefficient			R^2
		X1	X2	X3	
Rewa	-25.525	0.00678	-0.0036	-0.00038	0.6365
Raipur karchuliyan	21.6775	-0.00575	0.0036	-0.0014*	0.7718
Sirmaur	13.0393	0.0049	-0.0044	-0.0019*	0.6834
Gangev	28.570	-0.0012	-0.0003	-0.0011	0.5828
Java	-10.7932	-	0.0029**	-0.0003	0.8165
Mauganj	54.3602	-0.0015	-0.0056	-0.00058	0.7884
Naigarhi	36.2665	-0.0055	0.0011	-0.0006	0.7947
Hanumana	38.9888	-0.0023	-0.0005	-0.0009	0.5233
Teonthar	35.282	0.00058	0.00034	-0.0004	0.5464
Rewa District	-7.5833	0.000005	0.00029	-0.00011	0.5557

X1 = Net Irrigated area, X2 = Total irrigated area, X3 = Pulse irrigated area
*- Significant at p=0.05, **- Significant at p=0.01

CHAPTER-V
SUMMARY AND CONCLUSIONS

Rewa district of Madhya Pradesh was selected purposively for the conducting study on growth pattern of major crops with respect to area, production and productivity and to identify the major factors affecting the productivity of the major selected crops. The micro-level analysis was also carried out considering blocks within district as micro level unit for study. The Rewa district is comprises of 9 blocks viz., Rewa, Raipur karchuliyan, Sirmaur, Gangev, Java, Mauganj, Naigarhi, Hanumana and Teonthar. The proposed study is based on secondary data collected from different published and unpublished records. The data were mainly related to area, production, and productivity of major *Kharif* and *Rabi* crops. The major crops of the district are paddy and soybean in *Kharif* season and wheat and gram in *rabi* season. The required time series data were related to years 1997-98 to 2007-08. The collected data were analysed using suitable statistical techniques.

The linear as well as compound growth rate of paddy, soybean, wheat and gram acreage, production and productivity were estimated from the time series data (1997-98 and 2007-08) collected from the Commissioner of Land Record, Moti Mahal, Gwalior. The linear growth rates of area, production and yield were estimated by fitting linear regression equations of the form, $y= a + bx$, where y is the area/production/yield and x represented time variable. The compound growth rate of area, production and yield were also estimated be fitting exponential functions of the form $y=ab^x$, where y is area/production/yield and x represents time variable. The determinants of yield of paddy and wheat crops were estimated by fitting multiple linear equation of the form,

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5$$

where, Y is paddy and wheat yield; x_1 is net irrigated area; x_2 is total irrigated area; x_3 is rice/wheat irrigated area; x_4 is cereals

irrigated area; x_5 is the rice hybrid area; 'a' is constant and b_i's are respective regression coefficients of the independent variables.

The determinants of yield of soybean and gram were estimated by fitting multiple linear regression equations of the form,

$Y = a + b_1x_1 + b_2x_2 + b_3x_3$

where Y is yield in kg/ha; x_1 is net irrigated area; x_2 is total irrigated area; x_3 is Oilseed/pulse irrigated area; 'a' is constant and bi's are respective regression coefficients of independent variables.

Conclusions:

1. Variability in production of paddy in different blocks was higher mainly due to acreage and productivity variability.
2. High variability in production of soybean was mainly due to high acreage variability rather than productivity variability.
3. The moderately high variability in production of wheat as compared to variability in its acreage and productivity was mainly due to interactive action of variability of both area and productivity.
4. In case of gram, there was no relationship between the variability of area, production and productivity in different blocks of the district. However, in some blocks, Sirmaur, Java, Mauganj and Teonthar, the variability and production was higher than that in area and productivity.
5. The growth in area of paddy was found to be positive and significant for Sirmaur, Gangev, Hanumana and Teonthar blocks.
6. Due to introduction of hybrid technology the growth in production and productivity of paddy in all the blocks was positive and highly significant which resulted in significant growth in overall production and productivity of paddy in the district.
7. The significant reduction in acreage and production of soybean was noted for the whole district.

8. Soybean crop is vanishing from the cropping pattern due to irregular trend of monsoon rain and introduction of hybrid rice.
9. In case of wheat despite of reduction in acreage in four out of nine blocks, the productivity was increasing significantly which resulted in increased production of wheat in the district.
10. The growth in area of gram in most of the blocks was negative and significant to highly significant in four blocks, but growth in production was positive and highly significant in five blocks along with district level. Furthermore, growth in productivity of gram in all the blocks including district were positive and highly significant.
11. Net irrigated area and rice irrigated area for Rewa block and total irrigated block for Java block exhibited positive and highly significant influence on yield of paddy.
12. About 68 per cent variation in yield of paddy was contributed by all five variables taken under study. Some of the other variables like rainfall during crop season, fertilizer consumption may be included in the selection indices while determining the yield.
13. The variables total irrigated area positively and significantly influenced the yield of soybean in Java block whereas the variables, net irrigated area and oilseed irrigated area had significant and positive impact on yield of the soybean.
14. Only 32 per cent variation in the yield of the soybean was explained by all three studied variables.
15. Wheat irrigated area was found to be positively and significantly influencing the yield of wheat in Teonthar block and at district level. This variable may be included in selection criteria for determining the yield of wheat.
16. The yield of gram positively and significantly influenced by total irrigated area only in Java block. The multiple R^2 value was 55.57% at district level indicating that more than 46 per cent of the total variation in yield of gram was unexplained by all three variables taken under study.

Policy Implications:

1. With a view to reduce weather induced output fluctuations and to facilitate adoption of yield-raising improved technology, it is imperative that irrigation facility should be enlarged.
2. To increase the competitiveness of soybean with that of other oilseeds crops as well as cereals crops, it would be necessary to develop such new varieties of soybean which are not only high-yielding but also stable and resistant to pest and disease.
3. Paddy and wheat production technologies needs to be change according to climatic demand specially development of short duration varieties of paddy and heat tolerance early maturing varieties of wheat for rainfed and semi-irrigated conditions of the district.

APPENDIX

Table 1 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 1997-98)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	6602	9837	99030	127881	15	13	21475	6021	246963	72252	11.5	13
Raipur Karchuliyan	5827	3606	81578	43272	14	12	12024	5219	137074	57409	11.4	11
Sirmor	11012	6514	176192	81425	16	12.5	26052	7145	312624	82176.5	12	11.5
Gangeo	10247	3589	153705	48092.6	15	13.4	18226	8527	200486	98913	11	11.6
Jawa	10544	35	152888	462	1405	13.2	10546	6678	128661	81471.6	12.2	12.2
Mauganj	13263	2195	198945	28535	15	13	12315	5275	152706	63300	12.4	12
Naigarhi	12686	975	196633	12285	1505	12.6	10656	5926	122554	72297.2	11.6	12.2
Hanumana	18190	78	272850	990.6	15	12.7	15175	6267	171478	72697.2	11.3	11.6
Tenthar	16009	270	240135	3510	15	13	17479	11213	192269	134556	11	12
Rewa district	104380	27099	1571956	346453	3015	115.4	143948	62271	1664814	735073	104.4	107.1

Source : Agriculture Statistics Department of Rewa – 1998.

Table 2 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 1998-99)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	5519	10837	88304	151718	16	14	22407	6501	268884	84513	12	13
Raipur Karchuliyan	5575	3549	83625	46137	15	13	11625	5409	141825	71398.8	12.2	13.2
Sirmor	12012	6914	192192	91264	16	13.2	27053	8145	354689	97740	13	12
Gangeo	14047	3109	170123.8	43526	15.4	14	19125	9127	250537	111349	13.1	12.2
Jawa	10303	45	164848	616.5	16	13.7	10229	7376	128885.4	93675.2	12.6	12.7
Mauganj	14686	1274	237913	18090.8	16.2	14.2	13317	4875	175784.4	63862	13.2	13.1
Naigarhi	13263	885	217513.5	12478	16.4	14.1	11554	5226	157134.4	71623.2	13.6	13.2
Hanumana	23190	78	387273	1029.6	16.7	13.2	16140	6567	204978	78804	12.7	12
Tenthar	17009	235	272144	3055	16	13.1	18478	13088	240214	17044	13	13
Rewa district	115604	26926	1813936.3	367914.9	143.7	122.5	149928	66314	1922931.2	690009.2	115.4	114.4

Source : Agriculture Statistics Department of Rewa - 1999

Table 3 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 1999-2000)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	9168	5879	155865	88185	17.1	15	20208	7306	262704	106484	13	14
Raipur Karchuliyan	7135	2748	114160	38472	16	14	11547	5194	152420.4	73754.8	13.2	14.2
Sirmor	15224	5061	258808	71866	17	14.2	24952	8014	349328	104182	14	13
Gangeo	11275	1468	182655	20698	16.2	14.1	19573	6963	277936	93304.2	14.2	13.4
Jawa	9312	20	158304	294	17	14.7	11265	6225	148698	80925	13.2	13
Mauganj	15545	912	267339	13680	17.2	15	13389	4763	187846	66682	14	14
Naigarhi	14507	477	253872	7155	17.5	15	11432	4212	162334	59389	14.2	14.1
Hanumana	24307	86	422941	1238.4	17.4	14.4	16211	5648	218848	73424	13.5	13
Tenthar	18479	26	314143	364	17	14	18507	10506	259098	147084	14	14
Rewa district	124952	16677	2128087	241952.4	152.4	130.4	147084	58831	2019212	805229	123.3	122.7

Source : Agriculture Statistics Department of Rewa - 2000

Table 4 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2000-01)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	7926	5305	142668	83288.5	18	15.7	12678	7541	177494	113115	14	15
Raipur Karchuliyan	6433	3026	109361	45390	17	15	4114	5395	58478.8	82004	14.2	15.2
Sirmor	15052	2506	273946	38592	18.2	15.4	11249	7533	168735	108475	15	14.4
Gangeo	12684	2106	220701.6	33064	17.4	15.7	6576	7875	101270	110250	15.4	14
Jawa	10524	18	189432	277.2	18	15.4	8948	6291	125275	89332.2	14	14.2
Mauganj	14896	446	271107.2	7225.2	18.2	16.2	7452	5833	112525	87495	15.1	15
Naigarhi	15236	418	280342	6855	18.4	16.4	4740	4963	72522	75437	15.3	15.2
Hanumana	24242	35	453325	532	18.7	15.2	7191	5804	100674	81256	14	14
Tenthar	17424	112	313632	1724	18	15.4	12423	11435	186345	171525	15	13
Rewa district	124417	13972	2254514.8	216947.9	161.9	140.4	75371	62670	1103318.8	918889	132	130

Source : Agriculture Statistics Department of Rewa - 2001

Table 5 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2001-02)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	8370	5627	159030	90032	19	16	13301	7258	200845	116853	15.1	16.1
Raipur Karchuliyan	7096	2583	127728	41844	18	16.2	4233	5101	64341	81616	15.2	16
Sirmor	16435	3852	315552	61632	19.2	16	11267	7691	181398	118441	16.1	15.4
Gangeo	13548	1583	249283	24378	18.4	15.4	7247	8789	117401	131835	16.2	15
Jawa	9768	20	185592	318	19	15.9	7448	8525	114699	129580	15.4	15.2
Mauganj	15727	295	300385	4720	19.1	16	5924	6768	92414	108288	15.6	16
Naigarhi	14336	219	378118	3547	19.4	16.2	4114	4584	65824	14260	16	16.2
Hanumana	26342	35	516303	574	19.6	16.4	8679	6342	130185	95130	15	15
Tenthar	12838	44	346522	704	19	16	12973	4212	207568	179392	16	16
Rewa district	124460	14258	2578513	227749	170.7	144.1	75186	59270	1174675	975395	140.6	140.9

Source : Agriculture Statistics Department of Rewa -2002

Table 6 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2002-03)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	7857	5407	157140	91919	20	17	21008	6591	336128	101865	16	15
Raipur Karchuliyan	7392	2865	140448	45840	19	16	12003	5381	194448	91477	16.2	17
Sirmor	16020	3193	323604	51726	20.2	16.2	26952	8515	404280	137091	15	16.1
Gangeo	13975	1868	271115	29514	19.2	15.8	20673	7663	289422	120309	14	15.7
Jawa	11312	10	226240	160	20	16	11080	6790	166200	101850	15	15
Mauganj	16643	477	339517	8109	20.4	17	14398	3763	230224	60208	16	16
Naigarhi	15507	435	325647	6829	21	15.7	12430	4538	203852	71246	16.4	15.7
Hanumana	26307	95	536662	1520	20.4	16	17911	5148	272247	82368	15.2	16
Tenthar	19479	25	403215	405	20.7	16.2	19707	11706	329106	189637	16.7	16.2
Rewa district	134492	14375	2723588	236022	180.9	145.9	156162	60095	2425907	956051	140.5	142.7

Source : Agriculture Statistics Department of Rewa - 2003

Table 7 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2003-04)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	6896	5036	139299	90648	20.2	18	11222	6937	190774	117929	17	17
Raipur Karchuliyan	6175	2921	123500	46736	20	16	4010	5206	68972	83296	17.2	16
Sirmor	16052	2106	313014	36855	19.5	17.5	12149	8733	202888	141474	16.7	16.2
Gangeo	13084	1244	274764	19904	21	16	6076	7675	103292	138150	17	18
Jawa	10413	10	215549	164	20.7	16.4	8448	7291	146995	125405	17.4	17.2
Mauganj	16540	128	347340	2188	21	17.1	4720	3833	79632	62861	16.8	16.4
Naigarhi	15036	318	318783	5056	21.2	15.9	3012	4663	51204	75540	17	16.2
Hanumana	26742	35	532165	560	19.9	16	7591	5204	132083	83264	17.4	16
Tenthar	18424	112	368480	1881	20	16.8	13423	12435	237587	189012	17.7	15.2
Rewa district	129362	11910	2632894	203992	183.5	149.7	70651	61977	1213427	1016931	154.2	148.2

Source : Agriculture Statistics Department of Rewa - 2004

Table 8 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2004-05)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	7273	5317	152733	95706	21	18	11876	6596	213768	118728	18	18
Raipur Karchuliyan	6791	2835	143969	48195	21.2	17	4116	4879	74911	82943	18.2	17
Sirmor	17443	2499	348860	46481	20	18.6	12267	8691	218352	199485	17.8	17.2
Gangeo	14548	1353	311327	23001	21.4	17	6347	7789	114246	135528	18	17.4
Jawa	10768	10	236896	172	22	17.2	8592	7696	156374	139297	18.2	17.1
Mauganj	16727	105	357957	1890	21.4	18	4924	3585	85677	65247	17.4	18.2
Naigarhi	15336	200	322056	3200	21	16	3115	4308	54824	71082	17.6	16.5
Hanumana	27345	35	582448	395	21.3	17	7679	5340	138222	90780	18	17
Tenthar	19238	56	403988	963	21	17.2	13973	12525	254308	215430	18.2	17.2
Rewa district	135469	12410	2860234	220003	190.3	156	72889	61409	1310682	1118520	161.4	155.6

Source : Agriculture Statistics Department of Rewa -2005

Table 9 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2005-06)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	6684	5644	147048	107236	22	19	20877	6848	396663	130112	19	19
Raipur Karchuliyan	6236	3189	139686	54213	22.4	17	11425	4948	219360	84116	19.2	17
Sirmor	15801	3117	338141	55482	21.4	17.8	26929	9051	503572	164728	18.7	18.2
Gangeo	12875	1665	290975	29970	22.6	18	20207	8342	383933	145150	19	17.4
Jawa	9998	15	209958	261	21	17.4	11132	7765	215960	147535	19.4	19
Mauganj	12562	116	278876	1972	22.2	17	16303	3615	308126	65793	18.9	18.2
Naigarhi	19668	78	440563	1341	22.4	17.2	10365	4321	196935	77778	19	18
Hanumana	26817	45	579247	810	21.6	18	18352	5129	356028	97451	19.4	19
Tenthar	19258	25	423676	455	22	18.2	20122	12458	386342	224244	19.2	18
Rewa district	129899	13894	2848170	251740	197.6	159.6	155712	62477	2966919	1136907	171.8	163.8

Source : Agriculture Statistics Department of Rewa -2006

Table 10 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2006-07)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	6675	5813	153525	110447	23	19	21034	6606	420680	125514	20	19
Raipur Karchuliyan	6340	3635	147088	65430	23.2	18	11598	4992	220362	89856	19	18
Sirmor	16170	3077	367059	61550	22.7	20	27107	9003	487926	163854	18	18.2
Gangeo	13650	1478	315315	28377	23.1	19.2	20867	7617	396473	144723	19	19
Jawa	10157	20	233611	394	23	19.7	10983	1617	205660	32340	20	20
Mauganj	16394	107	375422	1926	22.9	18	13802	3606	278800	68514	20.2	19
Naigarhi	15859	227	371100	4313	23.4	19	14162	2962	281823	57462	19.9	19.4
Hanumana	26399	30	607177	540	23	18	17671	4752	342817	90288	19.4	19
Tenthar	20168	35	463864	595	23	17	20074	2522	409509	50440	20.4	20
Rewa district	131812	14422	3034161	273572	207.3	167.9	157298	43677	3044050	822991	175.9	171.6

Source : Agriculture Statistics Department of Rewa -2007

Table 11 Area, Production and Productivity of selected crops in different blocks of Rewa district in M.P.) (year 2007-08)

Block	Area (ha)		Production		Productivity		Area (ha)		Production		Productivity	
	Paddy	Soybean	Paddy	Soybean	Paddy	Soybean	Wheat	Gram	Wheat	Gram	Wheat	Gram
Rewa	6713	6830	161112	136600	24	20	20270	6017	425670	120340	21	20
Raipur Karchuliyan	6396	4184	147747	79496	23.1	19	11550	5103	254100	100529	22	19.7
Sirmor	14625	3623	345150	71373	23.6	19.7	21405	6913	430240	136877	20.1	19.8
Gangeo	13011	1839	312264	37147	24	20.2	19815	7834	420078	156680	21.2	20
Jawa	9132	30	206383	603	22.6	20.1	9812	6468	209976	122892	21.4	19
Mauganj	16232	165	373336	3135	23	19	13786	3479	289506	69580	21	20
Naigarhi	15538	317	372912	6244	24	19.7	12646	4239	252920	80541	20	19
Hanumana	26143	10	632660	204	24.2	20.4	17717	4731	379143	94620	21.4	20
Tenthar	18737	25	449688	500	24	20	16713	10761	350973	217372	21	20.2
Rewa district	126527	17023	3001252	335302	212.5	178.1	143714	55545	3012606	1099431	189.1	177.7

Source : Agriculture Statistics Department of Rewa -2008

Table 1 Independent factors in different block in Rewa district (year 1997-98)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	14125	3568	11268	9758	7562	5872	5291	8132	11426	77002
Total irrigated area	14877	3618	11268	9861	7652	5862	5316	8232	15428	82114
Irrigated Rice area	2640	2331	3854	3381	3690	4642	3805	5457	4802	34602
Irrigated Wheat area	6242	3006	6513	4556	2109	3078	2113	3793	4369	35779
Irrigated Total area	8723	4682	10804	8446	7153	9501	6804	11804	10400	78317
Irrigated Pulses area	3633	1599	2688	2693	2303	1679	1959	4655	5037	26246
Irrigated Oilseed area	83	73	77	67	37	40	83	30	30	520
Rice HYV area	1650	1340	2753	276	263	97	52	49	4642	11122
Wheat HYV area	5672	3607	8597	5336	3480	4187	3592	5311	6117	45899

Source : Commissioner of Land Record Moti Mahal, Gwalior - 1998

Table 2 Independent factors in different block in Rewa district (year 1998-99)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	13878	2618	11412	7958	7869	5712	4623	8243	10213	72526
Total irrigated area	14626	2721	11412	8262	8572	5612	4623	8343	12215	76386
Irrigated Rice area	1821	1895	4204	3755	3606	4993	4509	8116	5783	38682
Irrigated Wheat area	7842	4185	10280	7076	3682	4794	4274	5971	6836	54940
Irrigated Total area	10107	6204	14775	10746	9579	11042	9173	12825	13897	98348
Irrigated Pulses area	9514	2659	4354	4012	4380	3008	3532	4067	7043	42569
Irrigated Oilseed area	71	22	284	78	35	91	53	30	54	718
Rice HYV area	1379	144	324	298	2780	65	37	64	4762	9853
Wheat HYV area	6049	3255	7845	5355	3864	3861	3466	4842	5543	44080

Source : Commissioner of Land Record Moti Mahal, Gwalior -1999

Table 3 Independent factors in different block in Rewa district (year 1999-2000)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	14176	3618	10446	7959	7852	5682	4892	8243	11216	74084
Total irrigated area	14877	3862	11212	8316	8565	5798	4923	8323	16218	82094
Irrigated Rice area	3208	2568	5632	4059	3445	5750	5512	9236	7022	46432
Irrigated Wheat area	7679	4387	1481	7437	4393	5087	4344	6322	7032	48162
Irrigated Total area	11263	4562	10428	7812	9212	3944	62	7812	15162	70257
Irrigated Pulses area	1328	153	816	623	62	32	45	89	75	3223
Irrigated Oilseed area	72	65	64	32	65	42	21	4568	65	4994
Rice HYV area	2567	997	262	157	260	352	42	4701	5174	14512
Wheat HYV area	5860	3233	6986	5676	3154	3748	3200		5367	37224

Source : Commissioner of Land Record Moti Mahal, Gwalior 2000

Table 4 Independent factors in different block in Rewa district (year 2000-01)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	13876	2518	10546	9785	7552	5268	4582	8043	11623	73793
Total irrigated area	14877	2612	11212	8261	8562	5268	4672	8243	17263	80970
Irrigated Rice area	948	175	37	85	1526	12	68	22	7261	10134
Irrigated Wheat area	11200	10744	9786	6129	9212	4832	3652	4579	10312	70446
Irrigated Total area	13621	3612	10312	7512	9512	3844	52	7582	16192	72239
Irrigated Pulses area	1512	186	785	593	55	26	42	85	93	3377
Irrigated Oilseed area	65	72	32	26	62	32	16	42	75	422
Rice HYV area	726	152	27	62	1516	22	65	23	5182	7775
Wheat HYV area	4570	4268	6519	3280	4583	5233	3285	2512	4512	38762

Source : Commissioner of Land Record Moti Mahal, Gwalior -2001

Table 5 Independent factors in different block in Rewa district (year 2001-02)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	14378	3218	11510	7985	8759	5810	4232	8043	10213	74148
Total irrigated area	15268	3322	11610	7985	8869	5423	4354	8284	12784	77899
Irrigated Rice area	1852	621	250	162	1628	136	79	85	7168	11981
Irrigated Wheat area	10224	10212	9275	8509	11558	6935	4256	4578	12252	77799
Irrigated Total area	13582	4263	8962	7512	9343	5124	52	8551	1705	59094
Irrigated Pulses area	1513	162	978	693	75	98	106	98	95	3818
Irrigated Oilseed area	65	73	43	45	62	38	65	56	86	533
Rice HYV area	861	232	139	75	1416	109	75	97	5118	8122
Wheat HYV area	4562	4262	6395	3292	4567	4869	3612	3510	5410	40479

Source : Commissioner of Land Record Moti Mahal, Gwalior -2002

Table 6 Independent factors in different block in Rewa district (year 2002-03)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	14251	2268	9823	7238	8798	5268	4352	7269	11232	70499
Total irrigated area	15237	3265	9823	7238	9310	5256	4248	7757	19132	81266
Irrigated Rice area	789	363	210	105	2212	114	210	59	7327	11389
Irrigated Wheat area	11232	1867	8632	6537	5767	4905	3614	6249	10347	59150
Irrigated Total area	13875	1998	8675	8633	11212	4523	3832	6592	15123	60588
Irrigated Pulses area	1675	219	812	342	254	84	96	105	253	3840
Irrigated Oilseed area	68	67	59	38	46	59	41	75	125	578
Rice HYV area	727	233	152	115	1852	104	112	98	4932	8325
Wheat HYV area	692	291	4944	3231	4231	3482	2532	1576	4687	25666

Source : Commissioner of Land Record Moti Mahal, Gwalior -2003

Table 7 Independent factors in different block in Rewa district (year 2003-04)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	13878	2518	11212	9785	7559	5612	4523	8143	11213	74443
Total irrigated area	14624	2602	11212	8262	9575	5272	4245	8241	18784	82817
Irrigated Rice area	1742	521	216	205	1526	112	69	87	7161	11639
Irrigated Wheat area	11244	10733	10275	7509	11285	5933	4256	4878	11935	78048
Irrigated Total area	13861	3563	9862	7212	9243	4944	49	8751	18105	75590
Irrigated Pulses area	1412	152	878	593	78	86	105	112	92	3508
Irrigated Oilseed area	61	63	36	46	58	39	62	54	84	503
Rice HYV area	761	212	37	62	1316	112	78	105	5218	7901
Wheat HYV area	4252	4562	6295	3092	4565	4969	3517	3410	5210	39872

Source : Commissioner of Land Record Moti Mahal, Gwalior 2004

Table 8 Independent factors in different block in Rewa district (year 2004-05)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	14326	1680	13541	7538	9688	5051	4286	6727	13184	76021
Total irrigated area	14566	1890	13443	6709	9390	5053	4086	6727	19252	81116
Irrigated Rice area	1412	59	332	107	1531	63	45	52	4568	8169
Irrigated Wheat area	12125	1580	10192	5820	7312	4835	3561	215	11393	57033
Irrigated Total area	13537	1791	12205	9618	8937	4945	4365	6150	18971	80519
Irrigated Pulses area	1347	68	1412	362	98	45	64	62	182	3640
Irrigated Oilseed area	105	39	42	25	76	87	35	69	84	562
Rice HYV area	69	39	45	83	210	105	112	125	1653	2441
Wheat HYV area	5120	750	6212	2862	3211	4292	3215	115	6280	32057

Source : Commissioner of Land Record Moti Mahal, Gwalior -2005

Table 9 Independent factors in different block in Rewa district (year 2005-06)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	14113	1860	14251	7508	8688	5250	4086	7627	14184	77567
Total irrigated area	14566	1890	14483	7609	10309	5253	4089	7627	20752	86578
Irrigated Rice area	397	19	232	97	1621	23	13	23	5668	8093
Irrigated Wheat area	12001	1680	12092	6820	8302	4945	3661	314	13393	63208
Irrigated Total area	12526	1691	12505	6918	9937	4945	3665	6295	19971	78453
Irrigated Pulses area	1447	56	1512	262	78	24	44	62	150	3635
Irrigated Oilseed area	90	28	34	17	56	77	10	59	74	445
Rice HYV area	56	29	10	63	188	53	43	33	1753	2228
Wheat HYV area	4020	350	5210	2560	2211	4692	2815	100	6080	28038

Source : Commissioner of Land Record Moti Mahal, Gwalior -2006

Table 10 Independent factors in different block in Rewa district (year 2006-07)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	14877	2318	11546	7985	7959	5175	4283	8243	12623	75009
Total irrigated area	15624	2504	11545	8062	9585	5185	4349	8243	19784	84881
Irrigated Rice area	747	186	27	87	1626	10	66	25	7161	9935
Irrigated Wheat area	12744	12744	10175	7109	11985	4933	3856	4997	11935	80478
Irrigated Total area	13621	2226	10306	6200	9216	3944	51	7857	19105	72526
Irrigated Pulses area	1405	176	788	493	50	16	41	82	96	3147
Irrigated Oilseed area	62	62	26	16	54	38	12	45	74	389
Rice HYV area	660	108	17	60	1216	10	66	22	5018	7177
Wheat HYV area	4170	4170	6195	2980	4530	4933	3217	2410	4510	37115

Source : Commissioner of Land Record Moti Mahal, Gwalior -2007

Table 11 Independent factors in different block in Rewa district (year 2007-08)

Factor	Rewa	Raipur Karchuliyan	Sirmor	Gangeo	Jawa	Mauganj	Naigarhi	Hanumana	Tenthar	Rewa district
Net irrigated area	15250	2068	9813	7137	7898	5166	4156	7769	12732	71989
Total irrigated area	16039	2166	9813	7137	10310	5166	4157	7769	20039	82596
Irrigated Rice area	689	293	130	105	2412	14	100	21	7307	11071
Irrigated Wheat area	12967	1871	8362	6367	7567	4804	3640	6349	11767	63694
Irrigated Total area	13888	1988	8606	8622	19135	4918	3640	6392	19089	86278
Irrigated Pulses area	1575	119	710	289	154	14	54	55	236	3206
Irrigated Oilseed area	66	66	46	22	36	39	11	61	111	458
Rice HYV area	627	33	126	105	1951	14	14	12	4944	7826
Wheat HYV area	292	292	6944	4567	7652	4084	3026	1876	5653	34386

Source : Commissioner of Land Record Moti Mahal, Gwalior 2008

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A Study on Growth Pattern of Major Crops in Rewa district, Madhya Pradesh

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ABSTRACT

The linear as well as compound growth rate of paddy, soybean, wheat and gram acreage, production and productivity were estimated from the time series data (1997-98 and 2007-08). The determinants of yield of paddy, soybean, wheat and gram crops were estimated by fitting multiple linear equations. Variability in production of paddy in different blocks was higher mainly due to acreage and productivity variability. High variability in production of soybean was mainly due to high acreage variability rather than productivity variability. The moderately high variability in production of wheat as compared to variability in its acreage and productivity was mainly due to interactive action of variability of both area and productivity. In case of gram, there was no relationship between the variability of area, production and productivity in different blocks of the district. The growth in area of paddy was found to be positive and significant for Sirmaur, Gangev, Hanumana and Teonthar blocks. Due to introduction of hybrid technology the growth in production and productivity of paddy in all the blocks was positive and highly significant which resulted in significant growth in overall production and productivity of paddy in the district. The significant reduction in acreage and production of soybean was noted for the whole district. Soybean crop is vanishing from the cropping pattern due to irregular trend of monsoon rain and introduction of hybrid rice. In case of wheat despite of reduction in acreage in four out of nine blocks, the productivity was increasing significantly which resulted in increased production of wheat in the district. The growth in area of gram in most of the blocks was negative and significant to highly significant in four blocks, but growth in production was positive and highly significant in five blocks along with district level. Net irrigated area and rice irrigated area for Rewa block and total irrigated block for Java block exhibited positive and highly significant influence on yield of paddy. About 68 per cent variation in yield of paddy was contributed by all five variables taken under study. Some of the other variables like rainfall during crop season; fertilizer consumption may be included in the selection indices while determining the yield. The variables total irrigated area positively and significantly influenced the yield of soybean in Java block whereas the variables, net irrigated area and oilseed irrigated area had significant and positive impact on yield of the soybean. Only 32 per cent variation in the yield of the soybean was explained by all three studied variables. Wheat irrigated area was found to be positively and significantly influencing the yield of wheat in Teonthar block and at district level. This variable may be included in selection criteria for determining the yield of wheat. The yield of gram positively and significantly influenced by total irrigated area only in Java block. The multiple R^2 value was 55.57% at district level indicating that more than 46 per cent of the total variation in yield of gram was unexplained by all three variables taken under study.

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ABSTRACT

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