Crop Diversification and Agricultural Growth in Haryana
(A District Wise Study from 1980-81 to 2006-07)

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DECLARATION

I hereby declare that the dissertation entitled **"Crop Diversification and Agricultural Growth in Haryana (A District Wise Study from 1980-81 to 2006-07)"** is an original work submitted by me, **Rakesh,** to Jawaharlal Nehru University, New Delhi in partial fulfilment for the award of the degree of the Master of Philosophy. This dissertation has not been submitted for the award of any other degree of this University or to any other University to the best of my knowledge.

29-07-09
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It is hereby recommended that the dissertation may be placed before the examiners for evaluation.

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Rakesh

DEDICATED TO MY PARENTS

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Chapter 1

Introduction

Haryana has one of the most fertile states in India. It is doing well in industrial as well as agriculture sector. About 70% of the population is engaged in agriculture directly or indirectly. Haryana has achieved a remarkable growth in its agricultural sector, which not only has made it self-sufficient in foodgrains production but also has elevated it to the second largest contributor to India's central pool of food grains[1]. Even the share of agriculture sector is declining continuously. The share of agriculture sector in Gross State Domestic Product (at constant price 1999-2000) declined from 12.8 percent to 8.3 percent from 1999-2000 to 2006-07; after that it has very important role in Haryana's economy. ~~It contributes more than 8 percent of Gross State Domestic Product in 2006-07.~~

Though, the good show of agriculture sector is still on[2], there are many concerns which need urgent attention. The increasing dependence on traditional crops like wheat and rice is one of them. The ensured minimum support price has induced farmers to focus more and more on these crops. It has benefited the farmers but at the same time it has raised serious implications for the sustainability agricultural growth in medium and long run. The growing focus on paddy has not only resulted in to depletion in ground water table but has also aggravated the problem of land degradation. All these concerns call for an urgent need for crop diversification, which has the potential to effectively address all these issues. There are many instances where cropping system have successfully been diversified to retain or enhance the

[1] Economics survey of Haryana, 2007-08

[2] During 2006-07, there was increase in the production of almost all the crops. During this year, the production of rice, wheat, bajra, barley, gram, oil seeds, sugarcane, and cotton recorded increase of 5.5 percent, 13.6 percent, 45.0 percent, 45.6 percent, 26.4 percent, 1.1 percent, 15.3 percent and 20.7 percent respectively

value of natural resources principally land and water.[3] Agricultural diversification is being considered as the most appropriate strategy that augments growth, stabilizes farm income especially of the small farmers, generates full employment, protracts natural resources and attains the goal of food security[4].

Crop Diversification

Generally, there are two concepts in which resources are diversified from low value enterprises to high value enterprises, one is crop specialization and another is crop diversification. In crop specialization resources are diverted towards a few crops while crop diversification is a different aspect. The pattern of agricultural diversification shows a shift from crop production to livestock production. It implies a shift from single crop farming to multiple crops farming, from subsistence farming to commercial farming or from low value food crops to high value food or non-food.

However, it is hard to define the crop diversification; it is not a concept in which the resources shift from one crop to other crop, low value crops to high value crops, non-commercial crops to commercial crops. It is a whole process, in which the agricultural resources particular lands are diversified towards low value enterprises to high value enterprises. It may be one crop to another crop, non-commercial crop to commercial crop, one enterprise like (cropping rising) to another enterprise (say livestock)[5].

[3] Vyas V.S.(1996), Diversification of Agriculture: and Food security in the concept of New Economic Policy

[4] Bathla Seema (2008), Regional Dimensions of inter crop Diversification in India: Implication for Production and Productivity Growth.

[5] Thakur Kumar Anil, Padmadeo K B (2008), Growth and Diversification of Agriculture, Basu Lal Ratan, "Diversification of Agriculture in Eastern Indian and the Poor" p 20

In general sense, it can be divided in to two categories:

One Crop to another crop

- Diversification between food crops and non-food crops.
- Diversification between cereals and non cereals crops.
- Diversification between subsistence crops to commercial crops
- Diversification between food crops to non-food crops
- Diversification between food-grain crops and horticulture
- Diversification between low productivity crops and high productivity crops

The second category may be divided on the basis of crop to livestock:

- Diversification between agriculture and allied activities like crop to poultry farm, sericulture
- Diversification between agriculture and animal husbandry etc

Agriculture growth in Haryana

The agricultural production increased in almost the crops during the 1980s except maize, barley and massar. The food-grains production as a whole increased 58% from 1980-81 to 1990-91 and further it rose 39% during nineties and 11 % during 2006-07. Though, the production of total food-grains has increased continuously, the production of jowar and pulses have actually declined. *(See table no 1.3)*

The total growth in the production of rice, wheat, jowar and bajra rose, 47%, 84%, 35.4% and 8.4 % respectively from 1980-81 to 1990-91. Oilseeds registered highest growth in production by 239 % during eighties; while it showed negative growth rate during (-11.7%) during nineties. Bajra shows an increase of 8.7%, 24.7 % and 3.5 % during 1980-81 to 1990-91, 1990-91 to 2000-01 and 2000-01 to 2006-

07 respectively. Production of cotton has registered impressive growth over the period by 80 %, 19.7 % and 31 % from 1980-81 to 1990-91, 1990-91 to 2000-01 and from 2000-01 to 2006-07 respectively Sugarcane registered an impressive growth by 67.4 % from 1980-81 to 1990-91; but after that it showed a marginal increase in its production by 0.12 % only from 2000-01 to 2006-07. *(See table no 1.1)*

Table No:-1.1 Total Percentage growth in production

Crops	% increase in Production		
	1980-81 to1990-91	1990-91 to 2000-01	2000-01to 06-07
Rice	45.7	46.9	25.08
Wheat	84.5	50.1	3.99
Jowar	35.4	-64.6	4.35
Bajra	8.7	24.7	3.51
Maize	-41.0	-30.6	9.68
Barley	-40.9	10.3	-35.59
Gram	3.1	-82.9	-12.50
Moong	81.3	-69.0	238.89
Masoor	-6.9	-54.6	-12.24
Foodgrains	58.37	39.08	11.04
Oilseeds	239.36	-11.76	48.31
Total cotton*	79.63	19.74	31.16
Sugarcane	67.4	4.7	0.12

Data source: Statistical Abstract of Haryana 2007-08

*Thousand of bales of 170 k.g.

Gram which registered 3.1 percent total growth from 1980-81 to 1990-91 thereafter, it registered sharply declining trend during nineties and during 2000-01 to 2006-07 by (-82.9%) and (-12.5%) percent respectively. *(See table no 1.1)*

One point is to be noticed here that the production of almost all the crops increased during eighties except maize, barley and massar but during nineties there were many crops like jowar, maize, gram, moong, massar and oilseeds which showed negative growth in their production. Overall the production of total foodgrains and total cotton registered a remarkable growth over the periods. *(See table no 1.1)*

Crop diversification, agriculture growth and natural resources

Crop diversification is the panacea to enhance the low productivity, farm income, and increase the employment in rural area from agriculture. It improves both, quality and quantity of agricultural products. It provides a batter prices to farmers of their resources and desirable product to consumer. Indian agriculture adopted new technology during mid sixties, it was successful to enhance the productivity of all crops but more successful in case of rice and wheat. The new technology, which India adopted, was favourable in all terms except crops diversification[6].The new technology which India adopted is successful in all the states; however it is relatively more successful in agriculture advanced states like Haryana and Punjab.

However, the agriculture sector is growing due to crop diversification and agriculture growth by adopting new technology in it. After that there are many question arise here like, (i) crop diversification increase the productivity and production of all crops, (ii) Under crop diversification, natural resources are sustainable utilise (iii) Is it maintain a natural cropping trends (iv) is this agriculture

[6] Sharma R.K (1990) New Technology and Farm Size Efficiency: A Case Study Of Haryana

growth improve the productivity of all types of crops. (v) is this agriculture growth improve the all districts of the state or particular only for well irrigated areas etc.

The Objectives of the study are:

1. To analyse the growth pattern of Production, Area and Yield of major crops for all the districts of Haryana.
2. To examine the instability in crop production in each district of Haryana.
3. To estimate crop diversification in each district in Haryana; pre and post Reforms period.
4. To analyse the pattern of acceleration and deceleration in rate of growth of majors crops in Haryana.

Data Base:

The study is based on the secondary data of major crops production, area and yield for the years 1980-81 to 2006-07. The Data sources are given bellow:

- Statistical Abstracts of Haryana (1980-81 to 2006-07).
- Economic Survey of Haryana (Various issues).
- Statistical Abstract of India (Various issues).

Methodology:

To achieve the above mention objective of this study, it uses different methods to achieve different objective

To calculate the annual compound growth rate, a semi log equation below has been used

$$\text{Log } Yt = a + bt$$

Where Yt, is Area, production, and Yield of different Crop as (Rice, Jawar, Bajar, Maize, Wheat, Gram, Moong, Massar, Rape Seed and Mustard Groundnut, Sesamum, American, Desi and sugarcane), coefficient **b** shows the growth pattern.

To calculate instability of crop production Cuddy-Della Valle index has been used in the present study.

Cuddy-Della valle index[7] $= C.V.*(1-R^2)^{0.5}$

Where C.V. = Coefficient of Variation

R^2 = ESS/TSS i.e. ratio of explained variation to total variation.

ESS = Variation explained by explanatory variable.

TSS = Total Variation.

Variation can be measured by C.V. But due to presences of trend with variation in production with passes of time. Here C.V. adjusts with R2 to de-trend the production series, because it is statistically sound.

[7] The cuddy- Della Valle index takes in to account the time trend in a variable, which is not captured in the coefficient of variation the index is applied when a variable shows some trend which may be linear or non linear and such case Cuddy-Della Valle index is used as an appropriate measure of variability.

Crop diversification in Haryana, and application of Herfindahl index

There are many methods to measure crop diversification. Among them some important methods are, Herfindahl index, Index of maximum proportion, Entropy Index and Simpson Index, etc. Here Herfindahl Index is used to measure the diversification.

Herfindahl index is defined as:

$HI = \sum si^2$

si = the share of area of i^{th} crop of Gross Cropped Area, $si = Yi / Y$

Where Yi is the area of i^{th} crop and Y is Gross Cropped Area

The value of HI lies between 0 to 1. It indicates that the lower value of HHI shows more diversification, while the higher value show relatively more specialization of a few crops.

Acceleration and deceleration in growth rate

To study the acceleration and deceleration in growth rate of area, production and yields, one uses the semi-log quadratic equation as follow

$$\text{Log } Y = a + bt + ct^2$$

Where, Y is area, Production and Yield of ith crop

a = intercept, b and c are the coefficient of t and t^2 respectively which shows acceleration or deceleration in growth rate.

Framework of study

Choice of years

This study is analysing agricultural sector in Haryana pre and post economic reforms. There are many reasons behind it, like agricultural growth, crop diversification, to review the changes in cropping pattern pre and post economic reform. Indian agriculture adopted new technology during mid sixties, it was successful to enhance the productivity of all crops but more successful in case of rice and wheat. In This study it has been analyse the agricultural trends pre and post economic reform and want to know what types of changes took place in Haryana's agricultural sector.

To analyse these all types of pattern in agriculture sector during 1980-81 to 2006-07, it has been divided the overall period in three sub time periods, during 1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-01 to 2006-07. The first period of study (1980-81 to 1989-90) analyse the impact of new technology on agriculture sector particular in area production and yield. In second period (1990-91 to 1999-2000), the study analyse, what types of changes took place in Haryana's agriculture sector due to economic reform which held in June 1991. In third period (2000-01 to 2006-07) the study examines the impact on area, production and yield of economic reforms.

- To review the impact of new technology on the performance of agriculture production of all crops or some particular crops.
- To analyse the crop diversification among the crops either it took place in eighties or nineties.

Chapters Covered

In this study it have analysed the agricultural sector of Haryana pre and post economic reforms. In first chapter it has been discussed on agricultural sector in Haryana and explains about the growth and crop diversification in Haryana. Sources of data, objective and Methodology are given in this chapter. In second chapter it ~~has been explain~~ explained the demography, economy and agricultural sector of Haryana is briefly explained. In third chapter, the rate of growth of major fifteen crops of all districts is analysed at three time periods. In fourth chapter, the trend of crop diversification at all Haryana level and district-wise level has been analysed. The instability of all fifteen crops has been analyzed at three time period, 1980-81 to 1989-90, 1990-91 to 1999-2000and 2000-01 to 2006-07 at state level, while it studied broadly only major crops during the same time period. In chapter fifth, acceleration and deceleration in growth rate have been studied in all the periods.

Districts Covered

This Study is based on the analysis of district wise data pertaining of the 12 major districts namely Ambala, Kurukshetra, Karnal Sonipat, Rohtak Faridabad, Gurgaon, Mahendergarh, Bhiwani, Jind Hisar and Sirsa. There was 12 districts in 1980-81 in Haryana and this study is begun from 1980-81 so that to analysis easily those districts are separated from the particularly districts are combing them. The districts are Yamunanagar and Panchkula are added in Ambala, Kaithal is added in Kurukshetra, Panipat is added in Karnal, Jhajjar is added in Rohtak, Rewari is added in Mahendergarh, Fathehabad is added in Hisar, and Mewat in Gurgaon district.

Crops Covered

The agricultural data of area, production and yields is used for analysing the trends growth in area, Production and yields. This study is based on 15 major crops *viz. r*ice jawar, bajra, maize, wheat, barley, gram, moong, masoor, sesamum, groundnut, rapeseed and mustard, desi cotton, American cotton, and Sugarcane.

Review of Literature:

Chand Ramesh, S.S. Raju, Pandey L.M.(2007), Economic reforms initiated in India during 1991 has put Indian economy on a higher growth trajectory. Annual growth rate in total gross product has accelerated from bellow 6 percent during the initial year of reform to more than 8 percent in recent years. The approach paper to eleventh five year plan find that 8.5 percent growth in GDP is possible during the next five year. Agriculture which accounted for more than 30 percent of total GDP in beginning of reform failed to maintain its pre-reform growth or keep pace with growth in the non-agricultural sector. On the contrary it witnessed a sharp declaration in growth after the mid 1970. This is fact that agricultural productivity in most of the states was quite low and there was a lot of scope. In Indian five year plan, there is always a high target of increase the food grain production but almost it is fail to find the target. In 9^{th} five year plan 1996-97 to 2001-02 India has been targeting a more than 4 percent growth rate in Indian agriculture, but the actual growth rate has not turned out to be even half of this target. The poor performance of agriculture against the back ground of an impressive growth of the overall economy having serious implications. The slow growth of agriculture would not have caused an increase in disparities. More than 50 percent of work force and about depends on agriculture for income and livelihood, slow growth in agriculture in putting them in distress. The GDP of agriculture increased annually at more than 3 percent during the 1980 which was considered a reasonably satisfactory performance of the sector. During 1991 the country changes in regulations fiscal

policy, role of market force and others. The impact of these changes and various others factor was a small during the first six years of reforms. The growth rate of GDP in agriculture and allied sectors turned out to be 3.64 percent during the 1990-91 to 1996-97 which was 0.5 percentage points higher than previous decade.

Dhawan B.D (1983) investigates whether irrigation mitigates instability in agricultural production through the case study of Tamil Nadu. He measures the stabilization role of irrigation by comparing the irrigated output an un-irrigated output i;e rain fed output. He found that irrigating in Tamil Nadu does not reduce stability, because monsoon is the important determinant of irrigation infrastructure in Tamil Nadu. Although the growth in food grain seems to have improved because of the impact of new technology, the growth performance has not been smooth. The instability in food grain output has increased in the post green revolution period and even within the post green revolution period; the instability in the last decade (1978-79-198-89) was higher. However this increase in instability cannot be attributing to new technology. Rather this instability arises from adverse agro climate condition in which the technology is used. (Rao,1989). Ray (1983) found that (1) the major cause for change in the pattern of growth and instability were due to an increase in the variability of rain fall and (2) the new technology had made crop production in India more sensitive to variation in rain fall. Thus for a given variability in rainfall, the instability in output would be greater. However when the new technology is applied under assured irrigated conditions, the increase in output would be stable, i.e. the responses of high yielding varieties of seeds to modern output like fertilizers are considerable enhanced when field are properly drained, and water from irrigation sources are provided in controllable manner at the right times.

Ghosh Madhusudan (1998) the primary concern of his study is to examine the effect of agricultural development and agrarian structure on rural poverty. He finds there is inverse relationship between agricultural development and rural poverty. Agricultural development reduces the rural poverty. West Bengal stood 6th among the poor state, Bihar has the highest and Punjab the lowest of rural poverty. The main cause is agricultural development. Those states have good infrastructure which is agricultural developed.

Mitra K Ashok (1990) Agriculture growth with stability has been matter of concern in the strategy of agricultural development in the country in recent years .It is being contended in many quarters that although the seventies and eighties have noted high of growth in agricultural production., these high rates of growth are alleged to be accompanied by considerable year to year fluctuation given rise to increasing instability in agriculture production. There are many factors (inputs use, machineries, HYV,) which increase the production of food grains and reduce the instability. One other major factor is irrigations that direct effect the production of all crops.

Mahendradev S. (1987):- An analysis of fluctuations in food grains production, apart from growth, is of importance for understanding the nature of food security at regional level. A number of attempts have been made to examine the extent of instability in crops production. Growth and instability are positive associated. This study asses that trends in instability and unadjusted rate of growth for the period 1960-51 to 1984-85 revels that instability decline significantly in both high growth (Punjab, Haryana) as well as low growth states (Kerala ,Rajasthan and Bihar). The estimates of this study suggest more in favor of negative rather than positive association between growth rate and trends in insatiability. The cross section regression, in fact, indicates a significant negative relationship between unadjusted growth rate and trends in instability for the period 1960-61 to 1984-85.

Sharma R.K. (1990) states that, during the mid sixties there was a technological breakthrough in Indian agriculture. Haryana along with Punjab became the pioneer of new production technology generally termed the Green Revolution. The new technology consisted of a package of agricultural inputs like fertilizer high yielding varieties (HYV) of seed pesticides, controlled water supply and variety of mechanical equipment. These changes came about in Indian agriculture at a very crucial time when the possibility of increasing agricultural production through area expansion had almost been exhausted. Therefore, Indian agriculture was tending to stagnant. However, with the advent of new technology Indian agriculture once again started growing, mainly because of increasing yield of some crops such as wheat and rice. The study found out that the new technology, which India adopted, was favourable in all terms except crops diversification. The relative ability of small farms to convert inputs in to outputs is superior. The new technology seems to have generated positive gains forms of all size. However, it may be noted that the small farms have acquired relatively significantly higher gain in their output.

Rao (1998), according to Rao during nineties there are clear indications that the growth of foodgrains output has decelerated and there is some slow down even in the growth of total crop output when compared to the 1980s. This is corroborated by the slowdown in the growth of irrigated area and a sharp deceleration in the rate of growth of fertiliser consumption. This deceleration in the foodgrains output during the 1990s is explained by economic reform related factors, i e, insufficient reforms as well as improper sequencing of reforms. Reforms have been insufficient insofar as the exports of superior cereals like wheat and rice in which the country has a comparative advantage continue to be restricted. The main reason of declining the foodgrains production was increased the prices of inputs. A modest rise in the prices of fertilisers during this period, say, 5-7 per cent per annum, could easily

have been absorbed by the farmers resulting in a substantial reduction in subsidies. However, there was a sudden rise of 30 per cent in the prices of nitrogenous fertilisers and a doubling of the prices of phosphatic and potassic fertilisers following their decontrol in the early 1990s.This led to a sharp decline in the growth rate of fertiliser consumption from around 8 per cent per annum during the 1980s to only about 2 per cent per annum in the first half of 1990s. One of the most widely debated issues on Indian agriculture in recent years is the phenomenon of declining real public investment.

Likewise, Rao, (1989) also says that the instability in agricultural production had increased in the post Green Revolution period due to the rise in the sensitivity of output to variation in rainfall which shows the high complementarily of new seed fertilizer technology with water and inadequate expansion of irrigation facilities. Dev (1987) shows the relationship between growth and instability on state level. According to him moisture availability is the crucial factor of growth and it can be obtained either in the form of rainfall or irrigation. Moreover, variation in rainfall explains the variation in food grain production to large extent and besides variations in rainfall. The difference in the rainfall and quality of irrigation were also important to see the level of instability in production.

According to *IFPRI Discussion Paper 00727* (2007), between 1980/81 and 1995/96, the agricultural sector in India grew at a rate of 3.3% per year, and this growth had a significant impact on poverty reduction. This study shows that the growth in agricultural sector is more poverty-reducing than growth in other economic sectors. However, despite the past growth in this sector, agriculture in India is now beset with problems. Most importantly, agricultural growth decelerated to 2.1% between 1996-97 and 2002-03.

Saha Anamitra and Swaminathan Madhura (1994), In their study they analysis the agriculture production in West Bengal at district level and find out that from 1965 through 1980, the growth of agricultural production in West Bengal was low, and much lower than in the rest of the country. The situation changed distinctly in the 1980s. Agricultural growth accelerated and West Bengal did better than other eastern states and the rate of growth of foodgrains production was the highest among 17 major states in the country. From 1981-82 to 1991-92, West Bengal did better than the other eastern states (Bihar, Orissa and Assam) and the rate of growth of foodgrain production in West Bengal, 6.5 per cent per annum, was the highest among 17 major states of India. The scholars find out the reasons behind it were two major changes in rural West Bengal That were the Left Front came to power in 1977 are the implementation of a programme of limited land reform and the establishment of new democratic institutions in the form of the three tier panchayat system. One another reason behind it was Institutional changes in rural Bengal that occurred after 1980.

Singh Karam, Kalra Sajla (2002) this study looks at the various issues related to the huge expansion of rice cultivation in Punjab since the 1970. Punjab has its heroic status of continuously increasing production, accounting one third of the states food grain production and contributing significantly to the country's food grain security system.

V.S.Vyas (1996), state that, Indian agriculture is diversifying since the last two decades towards High-Value Commodities i.e., fruits, vegetables, milk, meat, and fish products. In India, as in other developing countries, the economy is diversifying at the macro level with the secondary and tertiary sectors becoming progressively more important in terms of contributions of national income as well as deposition of work force. The study find out that the share of agriculture in the gross domestic product of the country has progressively declined from 34.7 percent in 1980-81 to 27 percent in 1993-94. Due to crop diversification the area under

commercial crops has doubled since 1960s and half the area under food crops. Among the food crops the area under superior cereals, i.e., wheat and rice increasing, while the area under inferior cereal (Pulses, bajra, minor cereals) is declining.

Chapter 2

Physiography, Economy and the Agricultural Sector in Haryana

Haryana is located in northern India. It is located between 27°37' to 30°35' N latitude and between 74°28' and 77°36' E longitude. The altitude of Haryana varies between 700 to 3600 ft (200 meters to 1200 meters) above sea level.[8] An area of 1,553 km^2 is covered by forest. Haryana also surrounds Delhi on three sides, forming the northern, western and southern borders of Delhi. Consequently, a large area of Haryana is included in the National Capital Region. The capital of the state is Chandigarh which is administered as a union territory and is also the capital of Punjab. Haryana is now a leading contributor to the country's production of food-grain and milk. Haryana contributed heavily to the Green Revolution that made India self-sufficient in food production in the 1960s.

Economy:

The State economy continued to record an excellent growth during 2006-07 as well. The Gross State Domestic Product (GSDP) of Haryana at constant (1999-2000) prices has been estimated at Rs.92053.11 crore in 2006-07 as against Rs.82603.88 crore in 2005-06 recording a growth of 11.4 percent during 2006-07. The economy has been witnessing a growth of more than 9 percent during the last three years. At current prices, the Gross State Domestic Product has been estimated at Rs. 126474.66 crore in 2006-07 as against Rs.106385.26 crore in 2005-06 recording a growth of 18.9 percent[9]. The Per Capita Income (Per Capita Net State Domestic Product) in real terms at constant (1999-2000) prices has been estimated at Rs. 35779 during 2006-07 as against Rs.32724 during

[8] India, 2008
[9] Statistical Abstract of Haryana, (2007-08).

2005-06 showing an increase of 9.3 percent during 2006-07. At current prices, the Per Capita Income has been estimated at Rs.49038.

Haryana is one of the leading industrialized states of India, and is considered to be the current growth engine of India, with the city of Gurgaon rapidly emerging as a major hub for the information technology and automobile industries. Gurgaon is home to Maruti Udyog Limited, India's largest automobile manufacturer, and Hero Honda Limited, the world's largest manufacturer of two-wheelers. Panipat, Panchkula and Faridabad are also industrial hubs, with the Panipat Refinery being the second largest refinery in South Asia. There are also long established steel and textile industries in the state. Haryana's share in national production is 50% of passenger cars, 50% of motorcycles, 30% of refrigerators, 25% of tractors, bicycles and sanitary wares, and 20% of the country's export of scientific instruments.[10]

Agriculture Sector:

Agricultural development holds the key to the overall development of the state by way of creating employment, generating income providing raw materials to the industrial sector and ensuring food security to the poor. The excellent growth of 11.4 percent in the Gross State Domestic Product in real terms during 2006-07 is mainly due to outstanding performance of Agriculture Sector during this year. During 2006-07, there was increase in the production of almost all the crops. During this year, the production of rice, wheat, bajra, barley, gram, oilseeds, sugarcane, and cotton recorded increase of 5.5 percent, 13.6 percent, 45.0percent, 45.6 percent, 26.4 percent, 1.1 percent, 15.3 percent and 20.7 percent respectively.[11]

[10] *Economics Survey of Haryana 2006-07.*
[11] *Economic Survey of Haryana, 2007-08.*

Haryana has one of the most fertile lands in India. About 70% of populations depend on agriculture, wheat and rice is the major crops. Haryana is self-sufficient in food production and the second largest contributor to India's central pool of food grains. The main crops of Haryana are wheat, rice, sugarcane, cotton, oilseeds, gram, barley, millet etc. There are two main types of crops in Haryana: Rabi and Kharif. The major Kharif crops of Haryana are rice, jowar, bajra, maize, cotton, sugarcane, sesame and groundnut. The major Rabi crops are wheat, gram, rapeseed and mustard. The ground is prepared by the end of October or the beginning of November and the crops are harvested by March. About 86% of the area is arable, and of that 96% is cultivated. About 75% of the area is irrigated, through tube-wells and an extensive system of canals.

Agricultural Production of major crops in Haryana:

Table no 2.1, shows; a remarkable increase in foodgrains production is visible in Haryana since 1980-81. Production of total foodgrains is likely to increase from 60.36 lakh tonnes in 1980-81 to 156.77 lakh tonnes in 2007-08 showing an increase of 159.7 percent. The Wheat and Paddy crops have played a major role in pushing up the agricultural production. The production of Rice which was 12.5 lakh tonnes in 1980-81 is likely to increase to 33.71 lakh tonnes in 2006-07. Similarly, the production of Wheat which was 34.90 lakh tonnes in 1980-81 is likely to increase to 10055 lakh tonnes during 2006-07.

The production of paddy which was 12.59 lakh tonnes in 1980-81 has increase to 18.34 lakh tonnes in 1990-91 and further it has increased 33.71 lakh tonnes in 2006-07. The total share of wheat and rice in total foodgrains production was 78.6 percent in 1980-81 is increase 86.4 in 1990-91 and it becomes 90.06 in 2006-07. It shows that wheat and rice is the major foodgrains crops of Haryana. State made remarkable progress in the field

of agriculture production and it has emerged as the grain bowl of the country. Resultantly, foodgrains production touched an impressive figure of 147.63 lakh tonnes during 2006-07 from 25.92 lakh tonnes during 1966-67 registering a more than fivefold increase.[12] However the total production of foodgrains is increasing continuously h in case of pluses it is declining. The production of total pulses was 502.3 thousand tonnes in 1980-81; it increased 686.6 thousand tonnes in 1985-86. After that its trend started declining.

Table No: 2.1-The Agricultural Production of Major Crops in Haryana

(000 tones)

YEARS	WHEAT	PADDY	TOTOL PULSES	TOTAL FOODGRAIN	SUGAR-CANE	COTTEN	OILSEEDS
1980-81	3490	1259	502.5	6036	460	643	188
1985-86	5260	1633	686.6	8146	505	745	288
1990-91	6436	1834	541.7	9559	780	1155	638
1995-96	7291	1847	450.1	10171	809	1284	783
2000-01	9669	2695	99.8	13295	817	1383	805
2006-07	10055	3371	111.8	14763	965	1814	835

Data Source: Economic Survey of Haryana (2007-08). Cotton (000 Bales)

A remarkable increase in foodgrains production is visible in Haryana since 1980-81. Production of total foodgrains is likely to increase from 60.36 lakh tonnes in 1980-81 to 147.63 lakh tonnes in 2006-07 showing an increase of 149.7 percent. The Wheat and Paddy crops have played a major role in pushing up the agricultural production. The production of Rice which was 12.5 lakh tonnes in 1980-81 is likely to increase from 36.13 lakh tones to100.55 lakh tones in 2006-07 thereby showing the tremendous increase of

[12] *Economics Survey of Haryana, 2007-08.*

146.9 percent. Similarly, the production of Wheat which was 34.90 lakh tonnes in 1980-81 is likely to increase to 105.56 lakh tonnes during 2006-07.

Table No: 2.2-Percentage Change in the Agricultural Production of Major Crops in Haryana

Years	WHEAT	PADDY	TOTOL PULSES	TOTAL FOODGRAIN	SUGAR-CANE	COTTON	OIL-SEEDS
1980-81 to 1985-86	50.72	29.71	36.64	34.96	9.78	15.86	53.19
1985-86 to 1990-91	22.36	12.31	-21.10	17.35	54.46	55.03	121.53
1990-91 to 1995-96	13.28	0.71	-16.91	6.40	3.72	11.17	22.73
1995-96 to 2000-01	32.62	45.91	-77.83	30.71	0.99	7.71	2.81
2000-01 to 2006-07	8.66	34.06	11	17.92	18.53	36.30	11.80

Data Source: Economic Survey of Haryana (2007-08). Cotton (000 Bales)

The production of total cotton (American and Desi) is showed a remarkable increasing; it increased from 460 thousands bales in 1980-81 to 745 thousand bales in 1985-86, it was 15.8 percent higher than 1980-81. But a major change takes place in 1990-91, when the production of total cotton recorded 50 percent more than the production of 1985-86. It was 745 thousand bales in 1985 -86 it became 1155 thousand bales in 1990-91. After that it showed a marginal growth in its production.

The production of sugarcane, oilseeds and cotton is increasing continuously since 1980-81, the production of sugarcane was 46 lakh tonnes in 1980-81, is increase 78 lakh tonnes in 1990-91 thereafter it increase 105 tonnes in 2007-08. The production of oilseeds is increasing continuously; it increased from 1.88 lakh tonns in 1980-81 to 9.00 lakh tonnes in 2007-08. The production of cotton in the State is estimated to increase from

6.43 lakh bales in 1980-81 to 18.5 lakh bales in 2007-08. However the production of all major crops is increasing since 1980-81 except pulses. The growth in production of pulses is not satisfaction able, the total production of pulses was 24 thousand tonnes in 1980-81 which increased 55 thousand tonnes in 1990-91; but it was decline to 13 thousand tonnes in 2000-01.

Area under Crops:

The area under principal crops is increasing continuously since 1980-81. The Gross Area Sown which is 5462 thousand hectare in 1980-81 has increased to 5919 thousand hectares in 1990-91 and further increased to 6115 thousand hectares in 2000-01.

Table No: 2.3-Area Under Principal Crops (000 Hects.)

YEARS	WHEAT	PADDY	TOTOL PULSES	SUGAR -CANE	COTTON	OIL - SEEDS	GROSS AREA SOWN
1980-81	1479	484	795	113	316	311	5462
1985-86	1701	584	846	104	344	380	5690
1990-91	1850	661	742	148	491	489	5919
1995-96	1972	830	449	144	652	611	5974
2000-01	2355	1054	157	143	555	414	6115
2006-07	2377	1042	136	140	527	821	6509

Data Source: Economic Survey of Haryana (2007-08).

The area under wheat has been continuously increasing since 1980-81. The area under wheat was 1479 thousand hectares which is 27 per cent of the total gross sown area in 1980-81 has increased 1850 thousand hectares in 1990-91 and become 31.2 per cent of the gross sown area and further it increased 2355 thousand hectares which is 38.5 per

cent of gross sown area. The area under paddy is 484 thousand hectares in 1980-81, which is 8.86 percent of gross sown area and it has increased 661 thousand hectares in 1990-91, which increased from 8.86 % to 11.16% of the gross sown area.

On the other hand area under total pluses showed a sharply declined trend. However it registered a marginal during 1980's after that it declined sharply from 795 thousand to hectare in 1980-81, which was 14.6 percentage of gross sown area, during 1980-81 to 1985-86 there was a marginal increase in its area which became 846 thousand hectare in 1985-86, after that the area under pluses declined continuously and it became 136 hectare in 2006-07, which is 3.01 percent of gross sown area. The major change took place here is that the area under paddy which was 8.9 percent in 1980-81 increased to 16 percent in 2006-07, it showed double increase in its area, the area under pluses which was 14.6 percent of gross sown area in 1980-81, which recorded a sharply declining and it became 2.1 percent in in 2006-07.

Table No: 2.4-Percentage Area Under Principal Crops.

YEARS	WHEAT	PADDY	TOTOL PULSES	SUGAR-CANE	COTTEN	OILSEEDS	OTHER
1980-81	27.08	8.86	14.56	2.07	5.79	5.69	35.96
1985-86	29.89	10.26	14.87	1.83	6.05	6.68	30.42
1990-91	31.26	11.17	12.54	2.50	8.30	8.26	25.98
1995-96	33.01	13.89	7.52	2.41	10.91	10.23	22.03
2000-01	38.51	17.24	2.57	2.34	9.08	6.77	23.50
2006-07	36.5	16.0	2.1	2.2	8.1	12.6	22.6

Data Source: Economic Survey of Haryana (2007-08).

One point is noticed here is that the share of area under wheat and rice is increasing in all decades since 1980-81, while the share of area under total pluses is decreasing continuously. The share of area under sugarcane recorded almost constant since 1980-81, it lies between 2 and 3 percent in all the periods.

Yields of major crops in Haryana during 1980-81 to 2006-07

Year	Rice	Wheat	Jowar	Bajra	Cotton	Gram
1980-81	2606	2360	354	544	643	629
1985-86	2797	3094	244	487	745	821
1990-91	2775	3479	497	864	1155	722
1995-96	2225	3697	238	711	1284	1010
2000-01	2557	4106	208	1079	1383	640
2006-07	3051	3844	272	1117	1502	554

Data Source: Statistical Abstract of Haryana, 2006-07 (in Kg.)

Consumption of Fertilizers:

Fertilizer, the most important component of new technology has played a very important role in enhancing the agricultural production and ushering in green revolution in the State. Since the introduction of High Yielding Varieties in the State, the consumption of chemical fertilizers has increased steadily. Fertilizer consumption rose rapidly after mid sixties from 0.77 million tonnes in 1965-66, to a level of 22.04 million tonnes in 2006-07. The intensity of fertilizer use gradually went up from about 3kg/ ha to 96.6 kg/ hectare by 2004-05. During 2004-05, out of the 17 major states of India Punjab had the highest per hectare consumption of 193 k.g., followed by Haryana[13].

[13] Bhalla G.S. (2007), Indian Agriculture Since Independence,

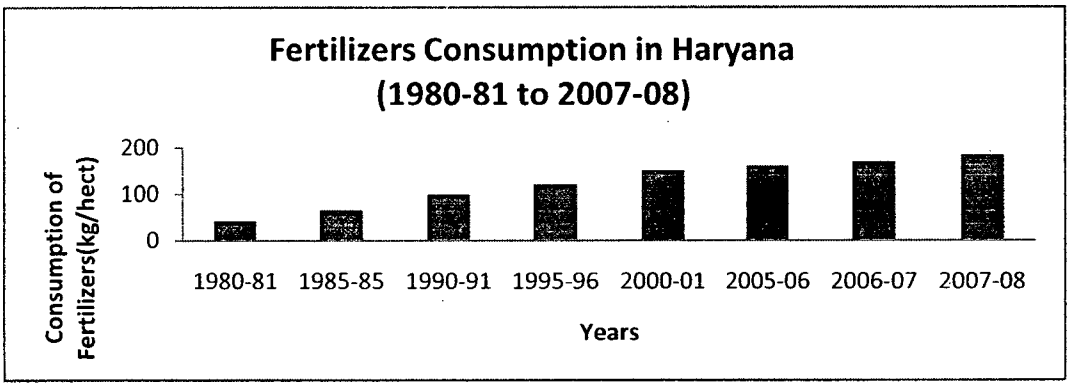
Table No: 2.5-Consumption of Fertilizers

Years	Consumption of Fertilizers (Kgs. per hectare)	Percentage increase in Fertilizer	No of Tractors on 100 Hect.	% Irrigation Area
1980-81	42	-	0.96	60.58
1985-85	66	57.14	1.28	56.59
1990-91	99	50.00	2.20	71.58
1995-96	121	22.22	2.71	78.22
2000-01	152	25.62	3.43	85.41
2006-07	170	4.94	3.90	83.75

Data Source: Economic Survey of Haryana (2007).

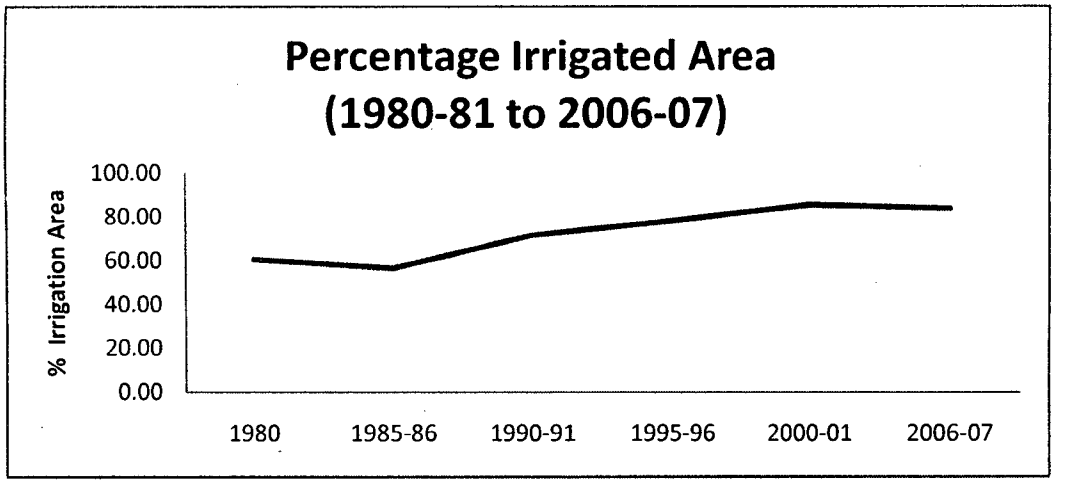
Fertilizer consumption is low in the rainfed areas since fertilizer use becomes highly risky under rainfed conditions.[14] In Haryana the growth in consumption of fertilizer was highest during eighties; it increased from 42 k.g/ha to 66 k.g/ha during 1980-81 to 1985 - 85, which showed 57 percent increased it became 99 k.g/ha in 1990-91. It increased sharply till 2000-01 and became 152 k.g/ha in 2000-01, but after that it showed a marginal increment. In 2006-07 the consumption of fertilizer is 170 k.g/ha in Haryana.

[14] Bhalla G S (2007), Indian Agriculture Since independence, p 108.



Data Source: Statistical Abstract of Haryana, 2007-08

Percentage Irrigated Area During 1980-81 to 2006-07



Data Source: Statistical Abstract of Haryana, 2007-08

Percentage area under Irrigation and numbers of tractors

Haryana has a very fine irrigation infrastructure. Irrigation in Haryana uses water either from under the ground or from surface through canals. Currently in Haryana, the most important technology for groundwater irrigation is the use of tube-wells with a submersible pump. The area under irrigation is increasing since 1980-81, it increased

from 60.5 percent to 71.5 percent from 1980-81 to 1990-91 and later it increase 83.7 percent in 2006-07.

The number of tractor is increasing continuously since 1980-81; it was 0.96 tractors on 100 hectares, which increased 2.20 tractors on 100 hectares in 1990-91. In 2006-07 it increases 3.90 tractors on 100 hectares.

In brief, the growth rate of Gross State Domestic Product (GSDP) in Haryana at constant (1999-2000) prices has been estimated 11.5 percent during 2006-07. The economy has been witnessing a growth of more than 9 percent during the last three years. Both industrial sector as well as agricultural sector has shown an impressive growth in Haryana during this period. The Per Capita Income (Per Capita Net State Domestic Product) in real terms at constant (1999-2000) prices has been estimated at Rs. 35779 during 2006-07 as against Rs.32724 during 2005-06, showing an increase of 9.3 percent during 2006-07.

The growth of agriculture sector in Haryana is recorded 9.7 percent in 2006-07, which is lower than overall growth of economy; still the agriculture growth in Haryana has been one of the highest among the states. During this year, the production of rice, wheat, bajra, barley, gram, oilseeds, sugarcane, and cotton recorded increase of 5.5 percent, 13.6 percent, 45 percent, 45.6 percent, 26.4 percent, 1.1 percent, 15.3 percent and 20.7 percent respectively.

There is an considerable growth in the input use and agriculture infrastructure in Haryana during 1990`s as compare to 1980`s. The consumption of fertilizer was has increased from 42 k.g/ha to 152 k.g/ha from 1980-81 to 2000-01, and further it increased to 170 k.g./ha in 2006-07. The number of tractor per 100 hectare has increased from 0.96 tractors in 1980-81 to 2.20 tractors in 1990-91, and in 2006-07 it increases to 3.90 tractors. Haryana has a relatively better irrigation infrastructure. The area under irrigation has increased from 60.5 percent in 1980-81 to 83.7 percent in 2006-07.

Chapter 3

Compound Growth Rate in Area, Production and Yields in Haryana

This chapter is primarily focused on the analysis of special pattern of changes in area production and yield in Haryana agriculture, first sections deals with the whole picture of Haryana's area production and yield; secondly it analyzes at district level during 1980-81 to1989-90, 1990-91 to 1999-2000 and 2001 to 2007-08. This study covered all the major crops like Rice, Wheat, Bajra, Maize Barley Gram, Moong, Masoor, sesamum, Rape Seeds and Mustered, Ground Nut, American Cotton, Desi Cotton and Sugarcane at district level. There are twelve districts, namely Ambala, Kurukshetra , Karnal, Sonepat, Rohtak, Faridabad, Gurgaon, Mehendergarh, Bhiwani, Jind, Hisar and Sirsa. The study analyzed the triennium year (TE) growth rate in area, production and yield for the respective crops.

To calculate the annual compound growth rate, we have a linear equation as

$$\text{Log } Yt = a + bt$$

Where Yt, is Area, production, and Yield of *ith* crop

a, is intercept while coefficient of b shows the growth pattern.

Compound Growth Rate in Production in Haryana

In Haryana, the growth rate of production shows a spatial pattern of changes in different crops. On the one hand, some crops like rice and wheat show a very satisfactory performance in production over the periods (1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-01 to 2006-07). On the other hand crops like Gram, Massar, Maize, Sesamum, show unsatisfactory performance in their production. The rate of growth of all these crops registered a negative growth rate in all over the periods. In the case of pluses, the production has shown a declining trend particularly in gram and massar. However, the production of seeds shows the declining trend, yet this performance is better than the

production of pluses. In the case of cotton it resisted a marginal growth during the overall time period. *(See Table No 3.1)*

In the case of total pluses, (Moong, massar and Gram) the production has shown a declining trend especially in gram. The production of rape seed and mustard registered a very impressive growth during 1980s, by 16.35 percent, after that it showed negative growth in both time periods, during 1990s and during 2000-01 to 2006-07. In the case of production of American Cotton it registered positive growth during 1980s and during 2000-01 to 2006-07. Desi cotton registered an impressive growth rate during 1990s and during 2000-01 to 2006-07. Sugarcane recorded positive growth rate in production during 1980s; after that it showed negative growth rate during second time periods and third time period. *(See Table No 3.1)*

Groundnut has recorded negative growth rate in production by -11.60% and -4.82% during first two time period, however it showed a very satisfactory growth rate by 15.35% during 2000-01 to 2006-07. Desi cotton recorded a negative growth rate (-7.11%) while American cotton showed a positive growth rate (6.95%) during 1980-81 to 1989-90. American cotton showed a very significant growth rate (15.39%) during 2000-01 to 2006-07. Sugarcane has registered a positive growth rate (3.26%) during 1980-81 to 1989-90, however, it showed negative growth rate by -0.22% and -0.23% during 1990-91 to 2000-01 and 2000-01 to 2006-07 respectively. *(See Table No 3.1)*

There are only two crops, wheat and rice, which showed a positive growth in production in all the time periods. Jawar registered negative growth rate by -3.08% and -7.03% during 1980-81 to 1989-90 and 1990-91 to 1999-2000 respectively but it show positive trend by 3.55% during 2000-01 to 2006-07. Rape seeds and Mustered recorded a significance growth by 16.35% during 1980-81 to 1989-90, but later it showed negative growth rate by -6.61%, -4.42% during 1990-91 to 1999-2000 and 2000-01 to 2006-07 respectively. *(See Table No 3.1)*

Table No: 3.1- Compound Growth Rate in Production in Haryana in Different Crops

CROPS	Growth Rate in Production In Haryana		
	1980-81 to 1989-90	1990-91 to 1999-00	2000-01 to 2006-07
Rice	2.29	4.36	3.30
Wheat	5.95	3.78	0.59
Jowar	-3.08	-7.03	3.55
Bajra	-3.36	4.81	4.45
Maize	-5.94	-0.34	-0.64
Barley	-4.41	-1.78	-5.33
Gram	-1.77	-9.53	-0.11
Moong	-2.24	-1.07	21.49
Masoor	-3.23	-4.29	-0.70
Sesamum	-0.14	-2.32	-2.19
Rape seeds*	16.35	-6.61	-4.42
Groundnut	-11.60	-4.82	21.37
American	6.95	-6.38	15.39
Desi	-7.11	9.37	8.67
Sugar cane	3.26	-0.20	-0.23

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08),

Rape seeds* = Rape seed and mustard

Compound Growth Rate in Area in Haryana:

The area under rice, wheat and total cotton has registered a positive growth rate during the all time period, while the area under maize, barley and massar showed a negative growth rate during the all time period. The most notable increase in area during 1980-81 to 1989-90 took place with Sesamum, it showed the highest growth rate by 6.06% , on the other hand it showed the highest declining trend by -4.45% during 2000-01 to 2006-07. *(See Table No 3.2)*

Table No: 3.2-Rate of growth in Area in Haryana during 1980-81 to 2006-07

CROP	Compound Growth Rate		
	1980-81 to 1989-90	1990-91 to 1999-00	2000-01 to 2006-07
Rice	2.39	6.09	0.79
Wheat	1.95	2.24	0.53
Jowar	-0.11	1.29	-3.72
Bajra	-3.85	0.06	1.05
Maize	-6.41	-5.06	-1.72
Barley	-7.89	-5.03	-0.49
Gram	-6.36	-9.62	0.96
Moong	5.12	7.25	5.27
Masoor	-5.76	-6.82	-2.63
Sesamum	6.06	-2.68	-4.45
Total Cotton	1.97	2.46	2.87
Sugar cane	0.24	-0.62	-2.64

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Area under cotton registered positive growth rate during all the time periods. However cotton is a commercial crop that is why area under cotton is increasing since 1980s, and another reason, it is a khriff crop and sown in rainfed districts where lack of irrigation facilities. *(See Table No 3.2)*

Compound Growth Rate in Yield in Haryana:

It is notable that almost all crops have recorded significant increase in their productivity except moong (-4.92%) groundnut (-4.77%) and sesamums (-3.41%) during 1980-81 to 1989-90. The most notable increase in productivity took place in the case of rape seeds and mustard by 7.81% during 1980-81 to 1989-90. The new technology enhances the productivity of all crops, but it is relatively more successful in rice, wheat and cotton. *(See Table No 3.3)*

Table No: 3.3- Compound Growth Rate in Yield in Haryana during 1980-81 to 2006-07

CROPS	1980-81 to 1989-90	1990-91 to 1999-00	2000-01 to 2006-07
Rice	0.57	-1.56	1.83
Jawar	2.93	-8.27	7.72
Bajra	1.25	4.33	5.36
Maize	2.69	4.83	2.07
Wheat	4.74	1.52	-1.43
Barley	5.09	3.44	-0.97
Gram	7.10	0.13	5.16
Moong	-4.92	-7.73	7.13
Massar	2.38	3.36	1.52
Groundnut	-4.77	-0.25	1.80
Sesamum	-3.41	-1.20	2.82
Rape seeds*	7.18	-	-
American Cotton	1.80	-2.87	13.25
Desi Cotton	0.42	0.62	20.45
Sugarcane	5.12	0.42	1.68

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08).

Rape Seed * = Rape Seed and Mustard,

Compound Growth Rate in Rice across the districts:

The results shows that the area and production of rice is increasing since 1908-81, even yield is increasing in all the time periods except 1990s at all Haryana level. During 1980-81 to 1989-90 there are five districts Ambala, Sonepat, Rohtak, Gurgaon, and Hisar in which there is positive rate of growth in area, production and yield. The highest rate of growth in area recorded in Faridabad (13.75 %) followed by Gurgaon (12.33 %) respectively. There is positive rate of growth in production in all districts except Kurukshetra, Sirsa, Mahendragarh and Bhiwani. *(See Table No 3.4)*

Table 3.4 Compound Growth Rate in Rice

	1980-81 To 1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	2.55	0.76	7.94	3.38	2.61	4.61	1.46	3.13	1.27
Kurukshetra	-3.14	-0.30	3.22	2.98	0.73	3.22	-0.55	3.02	3.21
Karnal	-0.99	0.31	0.90	3.34	1.81	0.93	0.54	2.68	2.75
Sonepat	12.03	9.91	9.25	14.55	10.30	5.87	-0.66	1.71	2.48
Rohtak	1.13	7.82	6.22	34.93	29.39	6.45	-0.68	1.16	6.67
Faridabad	13.75	2.64	-0.74	17.52	15.05	-1.18	17.79	-2.01	-1.61
Gurgaon	12.33	2.07	0.31	26.62	22.15	1.67	-10.58	22.62	3.02
M.gargh	-	-	-	12.49	-	1.35	-4.52	-1.02	2.92
Bhiwani	-6.23	-	-	56.23	-	-4.31	10.23	-1.58	-9.18
Jind	2.75	2.29	-1.23	11.25	9.39	1.35	-1.53	2.49	3.92
Hissar	4.92	3.90	1.87	13.00	9.64	2.62	2.49	7.78	3.37
Sirsa	1.53	-3.82	-2.79	4.58	3.32	0.41	3.02	6.86	3.61
Haryana	**2.39**	**2.28**	**0.57**	**6.09**	**4.32**	**-1.56**	**0.79**	**3.30**	**1.83**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

During 1990-91 to 1999-2000 the area under rice increased in all the districts. During this period it increased in those district which are depend on rainfall also as like Bhiwani, Gurgaon. The main reason behind it was expansion of irrigation facilities by the government and adoption the new technology of irrigation. There is positive growth in production in all the districts (In Bhiwani and Mahendragarh the data of production is insufficient).

During this (1990-91 to 1999-2000) period yield is also increased in all districts except Faridabad, and Bhiwani. The highest rate of growth in yield is in Rohtak (6.45), followed by Sonepat(5.87) and Ambala(4.61). While during 2000-01 to 2007-08 rate of growth in area under rice increased in many district like Kurukshetra , Sonepat, Gurgaon, Mahendragarh and Jind, however the rate of growth in production is increase in all these districts due to increase in rate of growth in yield except Mahendragarh.

Compound Growth Rate in Wheat:

Wheat is the major crop in Haryana that is why there is increasing trend in area, production and yield in all the three periods of time except during 2000-01 to 2006-07, in production and yield. During 1980-81 to 1989-90, the growth in area under wheat was 1.95%, production (5.97%) and in yield it was 4.74% at all Haryana level. During this period the area under wheat, declined in Sonepat (-2.05%), Kurukshetra (-1.04) and Mahendragarh (-0.15%), however the growth rate of production of wheat was increasing in all the districts due to improvement in productivity. *(See Table No 3.5)*

The growth rate in term of area was highest in Sirsa (14.34%) followed by Hisar (4.23%), Bhiwani (3.67%), Karnal (2.94%), Ambala (2.86%), Jind (2.84%), Rohtak (1.62%), Faridabad (14.18%), and Gurgaon (0.33%). The growth rate in production was highest in Hisar (9.07%) followed by Bhiwani (7.69%), Jind (6.99), Karnal (6.98%), Sirsa (7.44%), Kurukshetra (5.94%), Rohtak (5.81%) and Gurgaon (2.59%). There was an increasing trend in yield in all the districts. In Mahendragarh (5.04%) it was the highest while Sirsa (1.88%) experienced the lowest growth rate in yield. *(See Table No 3.5)*

The area, production and yield showed positive growth during 1990s, area (2.24%) production (3.78%) and yield (1.52%) showed an increasing trend in Haryana. Kurukshetra (-1.85%) was the district in which there was a declining trend in area. The growth rate in area was highest in Mahendragarh (7.93%) followed by Bhiwani (5.88%), Gurgaon (4.58%), Sirsa (3.71%), Hisar (2.94%), Sonepat (2.64%) and minimum growth in Karnal (0.06%). Yield increased in all districts except Sonepat (-1.95). The highest growth in yield was in Gurgaon (3.77%) followed by Faridabad (2.71%), Ambala (2.53%) while minimum growth was seen in Karnal (0.52%). *(See Table No 3.5)*

Table 3.5 Compound Growth Rate in Wheat

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield
Ambala	2.86	3.79	2.75	0.11	2.44	2.53	1.62	0.60	-0.43
Kurukshetra	-1.04	5.94	2.55	-1.85	-1.48	1.34	1.09	-0.33	-1.07
Karnal	2.94	6.98	2.13	0.06	0.20	0.52	0.58	-0.59	-1.43
Sonepat	-2.05	1.61	4.04	2.64	2.93	-1.95	0.03	-0.47	-0.87
Rohtak	1.62	5.81	3.70	1.62	3.18	1.92	-2.47	-3.90	-1.11
Faridabad	1.18	3.27	3.38	1.66	3.36	2.71	-2.27	-3.52	-1.39
Gurgaon	0.33	2.59	4.73	4.58	7.49	3.77	-0.19	-1.23	-0.15
M.gargh	-0.15	4.94	5.04	7.93	8.24	0.57	-3.68	-3.00	0.97
Bhiwani	3.67	7.69	4.17	5.88	7.33	1.03	-1.89	-2.00	-0.17
Jind	2.84	6.99	4.43	1.60	3.02	2.03	-0.03	-1.02	-0.95
Hissar	4.23	9.07	2.46	2.94	3.46	1.15	0.39	-0.91	-1.49
Sirsa	14.34	7.44	1.88	3.71	1.75	0.65	0.72	-1.81	-2.55
Haryana	**1.95**	**5.97**	**4.74**	**2.24**	**3.78**	**1.52**	**0.53**	**-0.23**	**-1.43**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08

The major change take place during 2000-01 to 2006-07, during this time period even the area is increased after that the production is declined due to decrease in productivity at the al-Haryana level. Yield shows declining trend in all districts except Mahendragarh, however production shows negative growth in all the districts. *(See Table No 3.5)*

Compound Growth Rate in Bajra

During 1980-81 to 1989-90, Bajra showed negative growth rate in area (-3.85%) and production (-3.36%), yield (1.25%) showed positive growth rate in Haryana during the period. There was a declining trend in area in all districts except Kurukshetra. The decline in area was found highest in Sonepat (-17.99%), Karnal (-12.99%), Sirsa (-11.34%), Hisar (-4.62%), Jind (-4.55%), Rohtak (-7.14%) and Gurgaon (-3.21%). So far

as production of Bajra in all districts showed declining trends except Kurukshetra (2.39%) and Mahendragarh (1.30%). Karnal (-16.68%) showed highest negative growth rate followed by Sonepat (-13.35%), Faridabad (-12.49%), Sirsa (-12.05%) and Rohtak (-5.87%) during the period. Yield shows positive growth rate in almost districts except Faridabad (-3.64%), Gurgaon (-0.98%), Jind (-0.70%) Ambala (-0.49 %) and Sirsa (-0.63%). *(See Table No 3.6)*

During 1990-91 to 1999-2000, during this period there were positive trends in area (0.06%), Production (4.80%) and, Yield (4.33%) in Haryana. Kurukshetra showed the highest declining trend in area (-18.18%), production (-0.80%) and yield (-7.58%). The increasing trends in area was found highest in Sonepat (5.84%) followed by Bhiwani (1.86%). There was only one district Kurukshetra (-7.58%) in which declining trend in yield was found. *(See Table No 3.6)*

Table 3.6 Compound Growth Rate in in Bajara

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-1.10	-6.73	-0.49	-1.87	0.75	1.82	-1.14	24.85	11.04
Kurukshetra	0.02	2.39	0.25	-18.18	-0.80	-7.58	13.65	26.07	8.46
Karnal	-12.99	-16.68	0.55	-6.61	11.85	12.74	-5.87	22.44	14.00
Sonepat	-17.99	-13.35	9.12	5.84	7.85	5.29	1.44	1.90	1.03
Rohtak	-7.14	-5.87	1.60	-7.77	7.68	9.61	-2.25	1.04	3.97
Faridabad	-8.83	-12.49	-3.64	-0.55	0.55	2.37	-4.80	-5.28	-0.59
Gurgaon	-3.21	-4.09	-0.98	-1.86	5.57	6.76	2.13	-2.29	-1.33
M.gargh	-2.60	1.30	6.53	-3.79	0.96	1.95	0.11	0.20	-0.25
Bhiwani	-2.25	-1.97	0.27	1.86	5.48	6.27	1.26	-0.38	-1.58
Jind	-4.55	-5.30	-0.70	-1.26	3.30	1.71	3.23	6.90	3.21
Hissar	-4.62	-2.16	2.64	-0.69	4.50	3.83	0.35	5.92	5.13
Sirsa	-11.34	-12.05	-0.63	-3.70	0.87	4.21	9.83	16.82	7.71
Haryana	**-3.85**	**-3.36**	**1.25**	**0.06**	**4.80**	**4.33**	**1.05**	**4.45**	**5.36**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Area, production and yield registered positive growth rate during 1990s at all Haryana level. Two more districts, Sonepat and Bhiwain registered positive growth rate in area production and yield. The growth rate in area was found highest in Kurukshetra (13.65%) followed by Sirsa (9.83%), Jind (3.26%), Gurgaon (2.43%), Sonepat (1.44%), Bhiwani (1.26%) and Hisar (0.35%). The highest growth rate in production is in Kurukshetra (26.07%) followed by Ambala (24.85%), Karnal (22.44%) and Sirsa (16.82%). In the case of yield Bihiwani (-1.58%) registered highest negative growth rate followed by, Gurgaon (-1.33%), Faridabad (-0.59) and Mahendragarh (-0.25%). *(See Table No 3.6)*

Compound Growth Rate in Jawar:

The area under jawar is decreasing continuously. There was negative growth rate in area and production, in Haryana during 1980s. There were five districts, Ambala, Rohtak, Gurgaon and Mahendragarh in which there are positive growth rates in area during 1980-81 to 1990-91, while Kurukshetra , Karnal, Sonepat, Bhiwani, Jind, Hisar and Sirsa had negative growth rates in area for the same time period. In Karnal (-10.62%) there was highest negative rate of growth of area followed, by Hisar (-8.90) and Kurukshetra respectively during 1980s. *(See Table No 3.7)*

There was negative growth in production of jowar in Haryana during 1980s. In Kurukshetra, Karnal, Mahendragarh and Jind there was positive growth rate, while in Sonepat, Rohtak, Faridabad, Gurgaon and Bhiwani showed negative growth rate in production during 1980s. *(See Table No 3.7)*

In the case of yield there was positive growth rate in Haryana (2.93%) during 1980-81 to 1989-90. There was the highest growth rate in Karnal (9.49%) followed by Kurukshetra (4.29%) and Jind (4.22%). In all these districts (Kurukshetra, Karnal and Jind) there were declining trends in area however there were increasing trends in

production due to increasing trends in yields. In Sirsa (-16.21%), followed by Faridabad (-16.21%), Gurgaon (-8.82%) Rohtak (-8.44%) Sonepat (-4.90%) and Hisar (-3.41%) there was decreasing trends in yield during 1980-81 to 1989-90. *(See Table No 3.7)*

There was increasing trends in area in Haryana (1.29%) during 1990-91 to 1999-2000, however there was a declining trends in production (-7.02%) and yields (-8.27%) in the same time period. Mahendragarh showed the highest growth in area (23.50%), (19.20%) in production and (11.32%) in yield. There were five more districts Bhiwani (9.80%), Faridabad (4.06%), Rohtak (4.40%), Sonepat (2.59%) and Hisar (1.11%) showed increasing trends in area during 1990-91 to 1999-2000, however all these districts showed declining trend in production due to decreasing in yield except Hisar (1.11%) which had growth in area and (4.29%) growth in production. The whole situation changed during 2000-01 to 2006-07. There was declining trends in area in Haryana (-3.72%) after that production (3.55) and yield (7.72%) showed positive growth rate. All districts showed increasing trends in yield except Mahendragarh during 2000-01 to 2006-07. *(See Table No 3.7)*

Table 3.7 Compound Growth Rate in Jawar

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	4.98	-	-	-	-	-	-	-	-
Kurukshetra	-6.89	4.29	4.75	-12.75	-	-	-8.49	-	-
Karnal	-10.62	7.40	9.49	-14.50	10.49	3.67	3.25	-	-
Sonepat	-6.38	-0.84	-4.90	2.59	-2.57	-4.12	1.39	6.36	4.70
Rohtak	1.47	-6.40	-8.44	4.40	-5.18	-2.91	-1.36	3.44	7.28
Faridabad	3.35	-4.40	-9.08	4.06	-1.61	-5.02	-8.98	-5.01	7.72
Gurgaon	1.58	-6.68	-8.82	2.06	-6.96	-1.86	-7.34	1.46	9.52
M.gargh	0.06	2.52	-5.43	23.50	19.20	11.32	-3.33	-	-1.18
Bhiwani	-4.79	-3.71	-6.46	9.80	2.24	2.14	5.41	-	6.01
Jind	-0.18	6.38	4.22	-9.14	-9.21	-6.39	-24.37	-	-
Hissar	-8.90	-	-3.41	1.11	4.29	3.16	-	-	-
Sirsa	-2.17	-	-16.21	-	-	-	-	-	-
Haryana	**-0.11**	**-3.36**	**2.93**	**1.29**	**-7.02**	**-8.27**	**-3.72**	**3.55**	**7.72**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Compound Growth Rate in Maize:

During 1980s, the area under maize has shown a declining trend in all the districts except Gurgaon (5.30%), Faridabad (4.9%) and Bhiwani (0.3%). The highest decline was in Sonepat (-8.6%) followed by Kurukshetra (-7.2%), Jind (-6.7%), Hisar (-3.4%) and Rohtak (-3.7%). There is declining trend in production in all the districts. Karnal (-7.7%) showed the highest declining trend in production followed by Sonepat (-7.6%), Kurukshetra (-6.4%), Ambala (-5.1%), Faridaba (-6.3%). There is positive trend in yield in Jind (9.4%) followed by Hisar (4.3%) and Kurukshetra (1%). *(See Table No 3.8)*

During 1990s In Haryana there was a negative trend in area (-5.02%) and production (-3.32%) while yield (4.83%) increased trend during this period. Jind is the only district in which area (30.60%) under Maize has increased except in all the districts it had declined trend. *(See Table No 3.8)*

During 2000-01 to 2006-07, the area (-1.72%) and production (0.62%) have negative trend while yield (2.07%) has positive trend in Haryana. The two districts, Sonepat (24.10%) and Ambala (1.54%) in which area under Maize have positive trend. *(See Table No 3.8)*

Compound Growth Rate in Barley:

At the the Haryana level, the growth rate in area recorded a decline trend in all the three time period. The declining growth rate under area was -7.89%, -5.03% and -0.49% during 1980-81 to1989-90, 1990-91 to1999-2000 and 2006-07 respectively. The production recorded the same declining trend (-4.4), (-1.78) and (-5.33) respectively during the same time periods. Yield showed increasing trend during 1980-81 to 1989-90 and 1990-91 to 2000-01, that was 5.09% and 3.44% respectively at the Haryana level. *(See Table No 3.9)*

During 1980-81 to 1989-90 there was declining trend in area in all the districts except Sirsa (0.19%). The highest declining trend was recorded in Kurukshetra (-20.51) followed by Sonepat (-16.18%), Karnal(-12.60%) and Faridabad(-11.99%). In case of production there was increasing trend in Bhiwani (4.90%), Sirsa (9.98%) and Hisar (7.37%). Expect these districts, there was declining trend in all the districts. The highest growth rate was recorded in Sirsa (10.24%) followed by Bhiwani (9.78%) and Hisar (7.37%). *(See Table No 3.9)*

During 1990-91 to 1999-2000, during the period there was declining trend in area in all the districts except Hisar (4.78%) followed by Sirsa (3.64%) and Bhiwani (0.79%). The declining trend was highest in Karnal (-24.01%) followed by Kurukshetra (-23.28%) and Ambala (-19.95%). Production showed the declining trend in almost districts, during this time period. Mahendragarh (-12.14) followed by Faridabad (-9.04) showed the highest negative growth rate in case of yield, during 1980-81 to 1989-90 there was increasing trend in all the districts, however it showed declining trend in some districts and increasing trends in some districts. *(See Table No 3.9)*

2000-01 to 2006-07, during this period there was negative growth rate in all area, production and yield, in Haryana. Sonepat (12.5%) and Bhiwani (1.9%) has recorded positive growth rate in area. On the other hand production showed negative growth rate in all the districts. Rohtak showed the highest negative growth in Barley that was 17.6% followed by Mahendragarh (-10.5%) and Faridabad (-9.0%).*(See Table No 3.10)*

Table 3.8 Compound Growth Rate in Maize

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-2.3	-5.1	-3.5	-2.46	1.16	2.79	1.54	1.75	-2.96
Kurukshetra	-7.2	-6.4	1.0	-8.10	-7.47	-1.02	-10.82	-	-
Karnal	-3.4	-7.7	-1.2	-12.12	-8.10	-2.76	-16.23	-	-
Sonepat	-8.6	-7.6	-3.9	-25.20	-	-	24.10	-	-
Rohtak	-3.7	-	-	-0.92	-	-	-22.70	-	-
Faridabad	4.9	-6.3	-10.5	-10.10	10.80	12.11	-26.32	-	-
Gurgaon	5.3	-	-	-	-	-	-	-	-
M.gargh	-	-	-	-	-	-	-	-	-
Bhiwani	0.3	-	-	-	-	-	-4.72	-	-
Jind	-6.7	-	9.4	30.60	-	-	-	-	-
Hissar	-3.4	-0.4	4.3	-20.80	-	-	-29.23	-	-
Sirsa	-1.1	-	-	-2.70	-	-	-	-	-
Haryana	**-6.41**	**-5.93**	**2.69**	**-5.06**	**-3.32**	**4.83**	**-1.72**	**-0.64**	**2.07**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table 3.9 Compound Growth Rate in Barley

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-9.08	-5.91	2.38	-19.95	-	-	-	-	-
Kurukshetra	-20.51	-8.69	5.34	-23.28	-	-	-	-	-
Karnal	-12.60	-6.80	7.68	-24.01	-	-	-16.3	-	-
Sonepat	-16.18	-14.22	7.75	-3.43	-	-	12.5	-	-
Rohtak	-5.86	-1.29	7.74	-3.33	1.04	-	-15.0	-17.6	-8.4
Faridabad	-11.99	-7.43	4.11	-7.80	-9.04	-1.65	-4.6	-9.0	-6.3
Gurgaon	-9.64	-11.95	0.84	-12.87	-6.72	-1.47	-4.7	-5.3	-1.2
M.gargh	-8.93	-5.21	0.50	-10.59	-12.14	-4.34	-31.1	-10.5	0.0
Bhiwani	-4.56	4.90	9.78	0.79	6.22	1.27	1.9	-1.0	-1.7
Jind	-5.03	-1.70	3.34	-3.90	-2.40	1.73	-11.6	-8.7	-1.0
Hissar	-0.51	7.37	7.80	4.78	5.47	4.11	-4.5	-6.6	-0.8
Sirsa	0.19	9.98	10.24	3.64	9.75	2.39	-8.7	-6.1	4.7
Haryana	**-7.89**	**-4.4**	**5.09**	**-5.03**	**-1.78**	**3.44**	**-0.49**	**-5.33**	**-0.97**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08

Compound Growth Rate in Gram:

At the Haryana level the area of gram has shown negative growth rate -6.36% and -9.62% during 1980-81 to 1989-90 and 1990-91 to 1999-2000 respectively, however it shows increasing trend during 2000-01 to 2006-07. On the other hand, production showed negative trend during the all time period. In case of yield, it showed positive growth rate in all the three time period. It was the highest growth rate in yield (7.10%) during 1980-81 to1989-90. *(See Table No 3.10)*

At district level area under gram has shown negative growth rate in all the districts during 1980s. Faridabad registered highest negative growth by (-10.39%) followed by Gurgaon (-10.16%) and Hisar (-9.21) during 1980s. However in some districts area showed declined trend after that production showed increasing trend due to a positive trend in yield. In Karnal area showed negative growth rate in area (-5.57%). After that production showed positive growth rate (11.00%) due to a positive growth rate in yield (26.81%). Bhiwani showed the highest positive growth rate in production (12.94%) and Gurgaon (-13.91%) recorded highest negative growth rate in production. In case of yield it recorded a satisfactory growth rate during 1980-81 to 1989-90 in all the districts. Ambala (49.19%) followed by Kurukshetra (37.06%) and Jind (34.22%) recorded positive growth rate showed a very good performance in yield. *(See Table No 3.10)*

During 1990-91 to 1999-2000 and production recorded a negative growth rate at the Haryana level. During 1980-81 to 1989-90 all districts recorded negative growth rate in area while during 1990-91 to 1999-2000 two districts, Sonepat(11%) and Rohtak (0.45%) recorded positive growth rate. Bhiwani district recorded a good performance in area (6.85%), production (10.15%) and yield (5.37%). Only four districts Hisar (-4.53%) followed by Faridabad (-2.45%), Jind (-2.69%) and Sirsa (-1.04) recorded negative growth rates in yield during 1990-91 to 1999-2000. During 2000-01 to 2006-07, Hisar (9.86) followed by Bhiwani (5.74%) and Ambala (3.88%) showed positive growth rate in area. Rohtak showed the negative growth rate in area, production and yield which are

being -10.13, -17.63 and -8.23 respectively. Hisar and Bhiwani recorded positive growth rate in production which worked out (1.99%) and 0.54% respectively. *(See Table No 3.10)*

Table 3.10 Compound Growth Rate in Gram

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-3.44	6.02	49.19	-5.90	2.85	1.28	3.88	-	-5.82
Kurukshetra	-7.68	9.57	37.06	-18.52	-15.66	1.21	-9.76	-	-
Karnal	-5.57	11.00	26.81	-13.25	-3.14	1.53	-14.18	-	-
Sonepat	-8.69	5.43	33.06	11.90	7.67	2.87	0.00	-	-
Rohtak	-5.89	1.50	17.36	0.45	1.55	2.63	-10.13	-17.63	-8.23
Faridabad	-10.39	-4.55	14.08	-8.95	-14.83	-2.45	-	-	-
Gurgaon	-10.16	-13.91	5.16	-3.28	3.40	4.52	-3.16	-7.16	0.26
M.gargh	-3.63	-13.21	13.33	0.21	3.92	3.59	-10.15	-18.99	-8.69
Bhiwani	-2.52	12.94	28.68	6.85	10.15	5.37	5.27	0.54	-3.80
Jind	-29.55	-3.07	34.22	-4.19	-2.49	-2.69	-6.20	-	-
Hissar	-9.21	0.75	20.29	-4.53	-1.35	-4.53	9.86	1.99	-6.21
Sirsa	-8.56	-2.31	17.16	-3.51	-1.01	-1.64	-3.71	-11.62	-3.07
Haryana	-6.36	-1.77	7.10	-9.62	-9.53	0.13	0.96	-0.11	-5.16

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08

Compound Growth Rate in Moong:

In Haryana, area (5.12%) under moong showed positive growth rate while in case of production and yield it showed negative growth rate that were (-2.23%) and (-4.92%) respectively. During 1980-81 to 1989-90 yields showed negative growth rate in all the districts except Sonepat. In Sonepat it recorded positive growth rate (3.47%) in yield. The highest negative growth in yield was recorded in Faridabad (-15.56%) followed by Gurgaon (14.63%) during 1980-81 to 1989-90. The district where production under moong has increased rapidly is Hisar (13.16%) while Faridabad (-13.77%) is the district in which production declined sharply during the period. During 1990-91 to 1999-2000, the area under moong increased but production and yield showed declining trend the Haryana level. The area under Moong showed a increasing trend in Faridabad (16.25%),

Bhiwani (25.83%), Sirsa (21.72%) and Hisar (12.65%) and the production trend in all these districts recorded a positive growth rate except Faridabad due to declining trend in yield (-3.57%). *(See Table No 3.11)*

The results show that the area and production of moong are declining in those distracts which have good irrigation facilities like Karnal, Ambala and Kurukshetra. The reason was diversification of area towards rice. *(See Table No 3.11)*

Compound Growth Rate in Massar:

The area and production under Massar at the Haryana level recorded a negative growth rate of -5.1-76% and -3.22% respectively whereas yield showed an increasing trend by 2.38% during 1980-81 to 1989-90 in all the districts, however the highest decline was observed in Sonepat i.e. (-22.32%) followed by Gurgaon (-16.62%), Faridabad (-16.50%) and Sirsa (-10.24%). The production of massar showed the declining trend in all the districts except Mahendragarh (3.85%). The highest negative growth rate was recorded in Sonepat (-14.61%) followed by Faridabad (-13.09%), however yield showed a positive growth rate in all the districts except Rohtak (-3.76%) and Gurgaon (-2.04%) during 1980-81 to 1989-90. *(See Table No 3.12)*

This is the same situation in area production and yield during 1990-91 to 1999-2000. Area (-6.82%) and production (-4.21%) showed negative growth rate while yield recorded positive growth rate by 3.36% at all the Haryana level. Area under Massar shown highest declining trend in Hisar (-17.28%) followed by Jind (-12.22%) and Kurukshetra (-10.53%). Ambala (3.18%) and Gurgaon (4.34%) recorded a positive trend in area during 1990-91 to 1999-2000 yield showed negative growth rate in Kurukshetra (-3.3%) only. Area and production at the Haryana level have shown negative growth rate by -2.63% and -0.70% respectively during 2000-01 to 2006-07. Kurukshetra (-10.26%) followed Karnal (-9.68%) showed the highest negative growth rate during the period. Ambala (-2.17%) followed by Jind (-1.13%) and Kurukshetra (-0.44%) have recorded negative growth rate in yield. *(See Table No 3.12)*

Compound Growth Rate in Groundnut:

Groundnut is an average crop of Haryana. Area under Groundnut has shown a negative trend by -7.89% and production by -10.3% during 1980-81 to 1989-90. Even the yield showed negative growth rate by -4.77% during the period. Area under groundnut, Sirsa was the only district which showed positive growth rate by 30.6%.; the highest negative growth rate under Groundnut recorded in Gurgaon (-22.2%) followed by Ambala (-12.0%), Sonepat (-1.0%) and Hisar (-1.1%). Production follows the same negative trend in all districts except Sirsa which showed positive growth rate by (10.6%) during 1980-81 to 1989-90. In case of the yield, all districts showed negative growth rate during the time period. *(See Table No 3.13)*

The production trend improved during 1990-91 to 1999-2000. The rate of the growth of production was negative during 1980-81 to 1989-90 which came positive from -10.3% to 3.09 % during 1980-81 to 1999-2000. Gurgaon showed improvement in production after first time period. The rate of growth of production in Gurgaon was negative -13.9% which showed a positive trend by 16.28% during 1990-91 to 1999-2000 and later it is recorded 11.8% during 2000-01 to 2006-07. *(See Table No 3.13)*

The major changes take place in the case of area during 2000-01 to 2006-07. Area showed negative growth rate in first time periods and second time period but it has shown a positive (6.42%) trend during 2000-01 to 2006-07. Gurgaon has shown highest positive growth rate (16.28%), followed by Hisar (13.28%), Mahendragarh (12.36%) and Sirsa (2.82%) in area during 2000-01 to 2006-07. *(See Table No 3.13)*

Compound Growth Rate in Rape seed and mustard

Repe seed and mustard showed more significantly positive growth rate in area production and yield at state lecel during 1980's. All districts showed the same trend of growth during the same time period. There was only one district Karnal which showed negative growth rate in area during eighty. *(See Table No 3.14)*

During 1990-91 to 1999-2000, production showed positive growth rate even declining in area due to increased in productivity at state level. Jind registered highest growth rate in area while Rohtak showed highest growth rate in production. *(See Table No 3.14)*

During 2000-01 to 2006-07, both area and production showed positive growth rate at state level. All district showed positive growth rate in area and production except Karnal. Yield showed the marginal growth in all the districts except Karnal, Faridabad and Mahendragarh. *(See Table No 3.14)*

Compound Growth Rate in Sesamum

Sesamum is average crop of Haryana, Area production and yield is declining since 1980-81 at state level. Even uield is increasing in some districts yet production declined in almost districs due to declined in area. *(See Table No 3.15)*

Compound Growth Rate in Cotton:

American Cotton showed positive growth rate in area, production and during 1980-81 to 19989-90 and during 2000-01 to 2006-07 at state level. While during nineties, area production and yield showed negative growth rate. Rainfed districts like Hisar, Sirsa ,Bhiwni and Rohtak showed relatively more singifincantly growth rate in area and production over the period. The reason behind it was that cotton is kharif crop and area is shifting toward cotton due to lack of irrigation facilities in these districts. The area,

production and yield registered significantly growth during 2000-01 to 2006-07. *(See Table No 3.16)*

Desi Cotton, area and production of Desi cotton registered negative growth rate during 1980's while yield showed positive growth rate in this period at state level. During ninties and uring 2000-01 to 2006-07, area, production and yield showed positive growth rate at state level. Bhiwani, Hisar, Jind and Sirsa showed relatively more growth rate in area and production during nineties and during 2000-01 to 2006-07. *(See Table No 3.17)*

Compound Growth Rate in Sugarcane:

The area under Sugarcane showed that at the state level, the trend growth was 0.24% in the period 1980-81 to 1989-90 but it declined to 0.62% in the period 1990-91 to 1999-2000 later it became 2.64% in 2000-01 to 2006-07. The production and yield showed positive trend during this time period by 3.26% and 5.12% respectively. *(See table no 3.18)*

At the district level Bhiwani showed the highest negative growth rate in area by -17.58% followed by Sirsa (-8.20) and Gurgaon (-7.07%). Faridabad (6.12%) followed by Ambala (4.85%) and Kurukshetra (4.13%) showed the highest positive growth rate in area during 1980-81 to 1989-90. The positive growth rate in production was found highest in Faridabad (13.37%) followed by Jind (13.37%) and Ambala (7.83%) during 1980-81 to 1989-90. On the other hand although yield showed positive growth rate in all the districts, it was the highest in Sonepat (9.20%) followed by Jind (5.80%) and Hisar (5.54%) during the same time period. *(See table no 3.18)*

Area (-0.62%) and production (-0.21) showed the declining trend during 1990-91 to 1999-2000. The highest growth rate under area was noticed in Sirsa (15.34%) followed by Bhiwani (9.84%) and Gurgaon (8.64%) during the period. The highest declining trend under area was noticed in Jind (-5.58%) followed by Faridabad (-3.86%). Yield showed positive trend in all the districts except Faridabad (-0.87%) followed by Sirsa (-0.18%)

during 1990-91 to 1999-2000.One point noticed in this study is that yield showed positive growth rate in all the three time periods at the Haryana level. Area and production recorded declined trend by -2.64% and -0.23% respectively at the Haryana level. Sirsa showed the highest negative growth rate by -34.24% in area however production showed a positive trend by 27.90% due to increment in yield at 0.31% during 2000-01 to 2006-07. Yield showed positive growth rate in all the districts except Rohtak (-2.56%) followed by this period. *(See table no 3.18)*

In brief, in Haryana, the growth rate of production shows changes in spatial pattern of different crops. On the one hand some crops like rice and wheat show a very satisfactory performance in their production in over the period (1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-01 to 2006-07). On the other hand crops like Gram, Massar, Maize, Sesamum, show unsatisfactory performance in their production. The rate of growth of all these crops registered a negative growth rate in all the three time periods. In case of pluses, the production has shown a declining trend in particularly gram and massar. However, the production of oilseeds shows the marginal increase in their growth, yet there performance is better than the production of pluses. Total Cotton has registered a marginal growth during all the periods. However, the growth rate in area, production and is better American cotton than the Desi cotton.

In the case of production, the study shows that there are only two crops rice and wheat which registered positive growth in all periods, while there are five crops, maize, barley, gram, massar and sesamum which registered negative growth rate in all periods at state level. It was found that the area and production of rice and wheat has increased over the time. The production of rice wheat registered an impressive growth during eighties and nineties. Rice and wheat registered 45% and 84 % large output from 1980-81 to 1990-91 respectively. While in the case of pluses the area and production has decreased over the time. Further, there is marginal increase in the production of coarse cereals while the

area has decreased. The possible reason of the decreasing area in the pulses and coarse cereals is the diversion towards wheat and rice.

Table 3.11 Compound Growth Rate in in Moong

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-	-	-3.99	-	-	-	0.22	-	-
Kurukshetra	3.89	-	-1.25	-	-	-	-	-	-
Karnal	0.00	-	-4.01	-	-	-	-	-	-
Sonepat	-9.17	-2.49	3.47	-	-	-	-	-	-
Rohtak	-1.25	-	-4.77	-	-	-	-	-	-
Faridabad	-20.79	-13.77	-15.56	16.25	-1.49	-3.57	17.66	-	27.28
Gurgaon	0.00	-	-14.63	-	-	-	-	-	-
M.gargh	12.91	2.84	-6.45	-6.11	-	-	-7.82	-	-
Bhiwani	-0.14	-7.82	-9.15	25.83	22.59	5.76	-2.45	32.66	34.20
Jind	4.46	0.42	-6.13	-	-	-	-	-	-
Hissar	18.79	13.16	-4.61	12.65	7.60	6.53	4.54	24.65	9.70
Sirsa	-7.09	-7.84	-4.16	21.72	23.74	13.46	-4.45	5.72	10.35
Haryana	**5.12**	**-2.23**	**-4.92**	**7.25**	**-1.07**	**-7.73**	**5.27**	**21.49**	**7.13**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table 3.12 Compound Growth Rate in in Massar

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-0.32	1.41	1.95	3.18	7.10	4.3	-4.01	-5.05	-2.17
Kurukshetra	-4.83	-1.22	1.02	-10.53	-8.42	-3.3	-10.26	-14.75	-0.44
Karnal	-5.89	-3.93	2.68	-	-	-	-9.68	-7.36	1.74
Sonepat	-22.32	-14.61	5.84	-	-	-	-	-	-
Rohtak	-6.56	-8.60	-3.76	-	-		-	-	-
Faridabad	-16.50	-13.09	1.21	-6.17	-8.92	0.5	-	-	-
Gurgaon	-16.62	-7.82	-2.04	4.34	-	-	-3.34	-14.76	-
M.gargh	-2.55	3.85	0.54	-	-	-	-	-	-
Bhiwani	-8.44	-8.34	1.20	-	-	-	-	-	-
Jind	-	-	-	-12.22	-	-	-	0.00	-1.13
Hissar	-8.77	-7.93	1.48	-17.28	-16.71	1.5	-	7.71	-
Sirsa	-10.24	-9.08	0.43	-	-	-	-	-	-
Haryana	**-5.76**	**-3.22**	**2.38**	**-6.82**	**-4.21**	**3.36**	**-2.63**	**-0.70**	**1.52**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08

Table 3.13 Compound Growth Rate in Groundnut

Districts	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield
Ambala	-12.0	-13.7	-0.5	-15.22	-12.80	-	-4.25	-2.45	-
Kurukshetra	-	-	-2.3	-	-	-	-	-	-
Karnal	-	-	-3.0	-	-	-	-	-	-
Sonepat	-1.0	-	-	-	-	-	-	-	-
Rohtak	-	-	-	-	-	-	-	-	-
Faridabad	-	-	-10.8	-	-	-	-	-	-
Gurgaon	-22.2	-13.9	-3.1	9.02	16.28	-	14.61	11.08	-
M.gargh	-	-	-1.4	-	-	-	12.36	8.57	-
Bhiwani	-	-	-	-	-	-	-	-	-
Jind	-	-	-	-	-	-	-	-	-
Hissar	-1.1	-4.0	-2.4	-10.94	-4.43	-	13.28	9.48	-
Sirsa	30.6	10.6	-5.1	8.14	14.73	-	2.82	1.09	-
Haryana	-7.89	-10.3	-4.77	-1.06	3.09	-	6.42	4.5	-

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table 3.14 Rate of Growth in Rape Seed and Mustard during

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield
Ambala	1.11	3.66	2.83	-5.32	-4.52	2.93	1.34	1.98	2.71
Kurukshetra	11.00	13.68	2.13	-17.87	-18.61	1.34	0.01	0.54	1.67
Karnal	-9.18	0.60	1.15	1.78	-1.87	-3.71	-3.86	-7.04	-2.28
Sonepat	1.70	3.79	2.84	6.75	8.38	2.14	1.82	7.10	4.49
Rohtak	17.45	26.61	9.12	7.17	9.51	1.44	4.86	2.41	2.15
Faridabad	6.43	13.89	6.41	-4.23	-6.11	1.84	2.74	0.16	-4.76
Gurgaon	10.38	14.32	4.43	-7.29	-6.45	-7.76	1.88	8.61	2.54
M.gargh	13.93	19.02	5.47	6.84	2.61	4.38	6.46	5.12	-1.06
Bhiwani	11.01	20.95	9.19	2.25	0.22	1.74	7.37	9.72	1.86
Jind	10.25	13.06	4.05	10.01	9.55	3.82	9.06	8.49	1.82
Hissar	6.96	12.34	6.10	1.60	5.16	2.57	5.95	12.81	3.88
Sirsa	9.88	19.51	12.00	2.43	3.01	1.9	0.59	12.66	9.39
Haryana	10.3	16.35	7.18	6.60	-6.61	-	2.85	4.42	-

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table 3.15 Rate of Growth in Sesamum

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-6.50	-4.52	3.00	-20.91	-3.71	3.5	-	-	-
Kurukshetra	3.71	6.61	-1.70	-17.32	-	4.9	-	-	-
Karnal	3.12	-	-0.81	-	-	-	-	-	-
Sonepat	-	-	-3.10	-	-	-	-	-	-
Rohtak	5.35	8.27	1.69	3.00	1.27	0.6	-0.84	-	-
Faridabad	-6.21	-3.70	-8.19	-8.87	8.33	3.7	-	-	2.75
Gurgaon	6.93	-5.97	-9.23	-6.21	10.79	6.3	-17.20	-15.40	1.26
M.gargh	-	-	-5.58	-19.55	-	-	-14.40	-	-
Bhiwani	-1.55	2.11	-4.33	-	-	-	-2.45	-	8.60
Jind	3.79	-0.94	-5.99	-10.30	-	-	-4.34	-6.59	6.44
Hissar	5.57	-5.61	-0.31	-6.02	3.60	4.2	-10.90	-12.82	-1.37
Sirsa	-	-	4.56	26.25	25.96	2.8	-9.94	-14.56	-4.02
Haryana	6.06	-0.14	-3.41	-2.68	-2.34	-1.20	-4.45	-2.19	2.82

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table 3.16 Rate of Growth in American

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-	-	-	-	-	-	-	-	-
Kurukshetra	-7.60	-6.32	-5.30	-9.23	-8.82	-3.7	41.78	-	-
Karnal	-13.83	-	-	-	-	-	-	-	-
Sonepat	-4.22	-7.63	-	12.22	-	-	27.98	6.18	3.42
Rohtak	1.63	0.07	-0.63	2.07	-0.10	2.4	13.69	25.03	17.43
Faridabad	-5.75	-	-	-	-	-	4.44	-	-
Gurgaon	-	-	-	-	-	-	-	-	-
M.gargh	-	-	-	-	-	-	47.02	37.94	-6.32
Bhiwani	6.79	2.87	-4.03	7.09	2.39	1.8	-9.27	10.84	10.35
Jind	10.23	11.26	-1.76	-1.37	-4.45	-3.6	5.82	20.37	13.12
Hissar	4.94	5.57	0.34	-3.06	-8.56	-2.3	0.62	16.06	22.02
Sirsa	6.07	5.41	1.64	0.16	-6.11	-4.7	2.28	22.55	24.45
Haryana	5.56	6.95	1.80	-1.4	-6.38	-2.87	2.55	15.39	13.25

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table 3.17 Rate of Growth in Desi Cotton

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	-12.05	-18.00	-5.21	-23.15	-	-	4.77	-	-
Kurukshetra	-5.32	-	-3.74	-16.43	-	-	11.81	23.93	-
Karnal	-8.95	-5.70	0.38	-12.99	-	-9.32	7.71	-	-
Sonepat	-6.12	-8.44	-0.46	-1.91	8.89	4.27	-20.98	-	-
Rohtak	-3.98	-	0.18	14.04	-	7.51	-9.26	4.45	20.01
Faridabad	-	-	-	-	-	-	-	-	-
Gurgaon	-	-	-	10.58	-	-	-7.16	-	-
M.gargh	-	-	-	70.95	37.64	9.23	-	-	-
Bhiwani	-10.90	-12.45	-2.13	36.95	27.52	8.41	-0.06	16.29	14.12
Jind	-5.28	-11.09	-5.16	16.11	9.49	-	-1.99	10.62	11.50
Hissar	-11.57	-12.16	-2.82	23.26	15.37	12.43	-5.49	10.67	11.80
Sirsa	-1.81	-1.35	0.47	11.43	3.78	-	-6.86	10.81	24.43
Haryana	-7.11	-7.04	0.42	15.8	9.27	0.62	2.58	8.67	20.45

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table 3.18 Rate of Growth in Sugarcane

	1980-81 to1989-90			1990-91 To 1999-2000			2000-01 To 2006-07		
Districts	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**	**Area**	**Prod**	**Yield**
Ambala	4.85	7.83	3.53	0.48	0.91	2.73	-3.23	-0.10	1.92
Kurukshetra	4.13	4.34	1.03	0.37	-0.01	2.35	-7.82	-5.82	3.66
Karnal	-7.07	-4.55	1.02	-0.67	1.64	1.60	1.50	2.90	2.17
Sonepat	-1.69	5.66	9.20	-0.63	-1.21	5.97	6.13	10.30	2.73
Rohtak	-0.96	0.93	0.83	-3.60	-4.18	-0.87	-2.23	-4.05	-2.56
Faridabad	6.12	16.97	3.06	-3.89	-3.92	0.87	-5.60	-6.98	-1.33
Gurgaon	-7.07	-3.97	3.21	8.64	-	2.64	6.18	-	-
M.gargh	-	-	-	-	-	-	-	-	-
Bhiwani	-17.58	-12.08	0.91	9.84	-	0.99	1.58	35.16	1.06
Jind	-1.40	13.37	5.80	-5.58	-6.46	4.50	-12.20	-7.32	3.20
Hissar	-5.34	-0.94	5.54	2.84	3.09	2.34	-18.40	-19.16	-0.87
Sirsa	-8.20	-	-	15.34	-	-0.18	-34.24	27.90	0.31
Haryana	0.24	3.26	5.12	-0.62	-0.21	0.42	-2.64	-0.23	1.68

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Chapter 4

Instability in Farm Production and Crop Diversification in Haryana

Instability in Farm Production

Instability measures the range of variation in different series; it may be in area, yield or production. Here it shows the range of stability in production among different crops. This chapter intends to measure the extent of instability in the production of major crops in the state. Since some crops like groundnut, sesamum and moong, have a very low and that is why their production is very low. The instability in crop production is analysed for three time periods, first time period, second time period and third time period as during viz., 1980-81 to 1989-90 (pre-reform period), 1990-91 to 1999-00 (post reform period) and 2000-01 to 2006-07 (post reforms period) respectively.

The agricultural instability can be measured by different methods, such as the coefficient of variation, dispersion, Cuddy Della Valle Index (CDI), etc. The present study applies the Cuddy Della Valle Index for measuring the instability. This Index first de-trends the given series and gives a clear direction about the instability. The use of coefficient of variation (CV) as a measure to show the instability in any time series data has some limitation. If the time series data exhibit any trend the variation measured by CV can be over-estimated, i.e. the region which has growing production are at constant rate will score high in instability of production. As against that Cuddy-Della Valle index attempts de-trend the CV by using coefficient of determination (R^2). Thus it is a better measure to capture instability in agricultural production. A low value of this index indicates the low instability in farm production and vice-versa. The present study divides the CDI value into three categories, which represent the different range of instability, to make the analysis more comparative by different crops across the districts in Haryana.

The ranges of instability are as follows:

1. Low instability = between 0 to 15
2. Median instability = greater than 15 and lower than 30
3. High instability = greater than 30

Production Instability among Different crops in Haryana

The study finds that instability in the production of Wheat, Sugarcane and Rice remains low during the first period, followed by Desi Cotton, Groundnut, Reap Seed and Mustard, Maize, Massar, Barely and American Cotton registered medium instability. Jawar, Sesamum, Moong, Gram and Bajra showed high instability In the second period, instability in the production of Rice and Wheat shows sharp declining trends. In the second period, three more crops American Cotton, Maize and Barley are registered into low instability crops which were noticed under medium instability crops during previous period. Gram and Moong still shows high instability in the second period. A major change takes place in Jawar in third time period. Jawar registered low instability in this time period. Wheat, Rice and Sugarcane recorded declining trends throughout the period. On the other hand, Gram and Moong were recorded as high instability crops. (*See Table No 4.1*)

Table No: 4.1-Production Instability among crops in Haryana

	LOW INSTABILITY CROPS		MEDIUM INSTABILITY CROPS		HIGH INSTABILITY CROPS	
			Desi	16.51		
	Wheat	6.30	Groundnut	17.65	Jowar	32.92
	Sugarcane	12.15	RP seed*	18.41	Sesamum	33.29
1980-81	Rice	12.73	Maize	19.38	Moong	34.54
TO			Masoor	20.54	Gram	42.98
1989-90			Barley	20.64	Bajra	44.91
			American	25.83		
	Wheat	4.81	Groundnut	16.19		
1990-91	Rice	7.20	RP seed*	16.48		
TO	American	7.27	Desi	20.38	Gram	34.34
1999-2000	Barley	11.02	Masoor	25.57	Moong	37.38
	Maize	11.4	Sesamum	26.81		
	Sugarcane	11.78	Jowar	28.02		
			Bajra	28.82		
	Wheat	4.42	Maize	15.63		
2000-01	Rice	5.75	RP seed*	18.91	Gram	30.3
TO	Jowar	7.23	Americn	21.39	Moong	30.91
2006-07	Sugarcane	10.55	Bajra	23.91	Sesamum	56.98
	Barley	12.55	Masoor	25.55		
			Desi	28.45		

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

RP Seed* = Rape seed and mustered, American = American Cotton, and Desi = Desi Cotton.

Production Instability in Rice across the Districts:

The trends rate of instability in the production of rice declining in Karnal, Kurukshetra, Ambala, Jind, Hisar, Sirsa and Faridabad throughout the study period. Ambala had medium instability during the first period and in the next period it had the lowest instability. Karnal and Kurukshetra, which showed the lowest instability during the first period, have recorded medium instability in second period. Gurgaon, which recorded medium instability during the first period, has recorded highest instability during third period of time. Rohtak has recorded high instability during first and second period, while it shows medium instability during 2000-01 to 2006-07. Because of rain fed area, the

instability of rice in Gurgaon is increasing over the time period and registered as the highest instability district during 2000-01 to 2006-07 (See Table 4.2).

Production Instability in Jowar across the Districts:

Even in case of Jowar instability showed a declining trend but it is still high in many districts in 2000-01to 2006-07.Duiring 1980-81 to 1989-90 there was no district under the low instability category. Sonepat, Bhiwani Mahendragarh and Karnal recorded under medium instability in second period. Gurgaon recorded statistically significant downward trends during the third time period. Sonepat and Rohtak are two additional districts that showed significant declining trends during third time period. No one districts recorded under low and medium categories during second time period. At Haryana level instability recorded a significant downwards trend in all the time periods. (*See Table No 4.3*)

Table No: 4.2 - Production Instability in Rice

Rice	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability		-	Ambala	5.1	Kurukshetra	1.52
			Sirsa	6.9	Sirsa	5.5
	Karnal	7.32	Sonepat	9.3	Karnal	5.59
	Kurukshetra	10.61	Faridabad	9.5	Ambala	6.95
			Hisar	10.4	Hisar	9.94
			Jind	11.1	Mahendragarh	12.01
Medium Instability	Sirsa	16.13	Karnal	16.93	Sonepat	17.97
	Gurgaon	17.64	Gurgaon	22.08	Faridabad	18.78
	Hisar	17.69	Kurukshetra	23.74	Jind	20.26
	Ambala	23.88			Bhiwani	21.29
	Jind	23.99			Rohtak	29.74
	Sonepat	24.69				
High Instability	Rohtak	40.09	Rohtak	40.42	Gurgaon	75.89
	Faridabad	71.09	Mahendragarh	-		
	Mahendragarh	-	Bhiwani	-		
	Bhiwani	-				
Haryana	Rice	12.73	Rice	7.20	Rice	5.75

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table No: 4.3-Instability in Jowar across the districts

Jowar	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability					Sonepat	5.41
					Rohtak	7.81
Medium Instability	Sonepat	22.96				
	Bhiwani	24.52				
	Mahendragarh	27.88			Gurgaon	23.64
	Karnal	28.37			Faridabad	24.49
High Instability	Kurukshetra	31.63	Gurgaon	31.52	Kurukshetra	-
	Rohtak	37.94	Hisar	31.63	Karnal	-
	Faridabad	49.38	Bhiwani	33.13	Mahendragarh	-
	Jind	50.22	Faridabad	38.30	Bhiwani	-
	Gurgaon	53.56	Sonepat	40.03	Jind	-
	Hisar	-	Jind	53.85	Hisar	-
	Sirsa	-	Karnal	55.28	Sirsa	-
			Rohtak	64.19		
			Mahendragarh	73.76		
			Kurukshetra	-		
			Sirsa	-		
Haryana	Jowar	32.92	Jowar	28.02	Jowar	7.23

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Production Instability in Bajra across the Districts

Instability in the case of Bajra has recorded a declining trend throughout the study period. One district recorded under low category two districts namely; Karnal and Jind were recorded under medium instability during the first period, whereas other districts showed high instability during the first period. Even instability trends declined in all the districts but it significantly declined in Hisar, Rohtak, Kurukshetra and Sirsa; these districts showed under high instability during first period which recorded under low instability during third period. Faridabad recorded increasing trend in instability from

second time period to third time period. Karnal, which was recorded under low instability in the first period changed to high instability during the second and third time periods. (*See Table No 4.4*)

Table No: 4.4- Production Instability in Bajra

Bajra	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability					Hisar	5.58
					Rohtak	8.6
					Kurukshetra	11.67
					Sirsa	12.34
Medium Instability	Jind	25.62	Faridabad	20.00	Jind	17.6
	Karnal	26.01	Gurgaon	21.18	Gurgaon	19.48
			Jind	24.50	Bhiwani	23.15
			Hisar	25.51	Sonepat	24.93
			Ambala	27.30		
			Bhiwani	28.99		
High Instability	Hisar	32.34	Rohtak	32.51	Karnal	31.55
	Ambala	35.01	Sirsa	39.32	Mahendragarh	32.22
	Sonepat	41.16	Sonepat	40.15	Faridabad	32.62
	Faridabad	41.38	Mahendragarh	41.07	Ambala	44.27
	Sirsa	43.16	Karnal	41.37		
	Gurgaon	43.83	Kurukshetra	48.32		
	Kurukshetra	46.74				
	Rohtak	54.14				
	Bhiwani	60.85				
	Mahendragarh	76.28				
Haryana	Bajra	44.91	Bajra	28.82	Bajra	23.91

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08

Production Instability in Wheat across the Districts

The trend rates under wheat reveal that instability varied from a high declining trend in all the districts. For instance, Karnal is an advanced district in agriculture, yet even then it showed medium instability during the first two time periods. There is no one district under high instability in all the time periods. (*See Table No 4.5*)

Table No: 4.5- Production Instability in Wheat

Wheat	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability	Kurukshetra	6.63	Hisar	3.26	Jind	1.3
	Rohtak	9.86	Bhiwani	3.93	Kurukshetra	2.32
	Faridabad	9.89	Faridabad	4.85	Karnal	2.49
	Bhiwani	9.95	Jind	5.59	Rohtak	2.58
	Hisar	10.4	Gurgoan	6.50	Hisar	2.7
	Jind	10.72	Ambala	7.21	Sonepat	3.05
	Gurgaon	10.85	Sirsa	8.17	Mahendragarh	3.05
	Sirsa	11.26	Rohtak	9.96	Ambala	3.88
	Sonepat	11.8	Sonepat	13.40	Sirsa	3.94
	Ambala	12.05			Bhiwani	4.27
	Mahendragarh	14.84			Gurgaon	5.47
					Faridabad	8.33
Medium Instability	Karnal	34.91	Karnal	17.61		
			Mahendragarh	22.98		
			Kurukshetra	26.61		
High Instability						
Haryana	Wheat	6.30	Wheat	4.81	Wheat	4.42

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

The trends rate of production instability is below the range of 10 in all the districts during 2000-01 to 2006-07. Jind registered a high declining trend in wheat during the all time periods. At the all Haryana level instability is under low category in all the time

periods and registered declining trends in all time periods. Kurukshetra which recorded the lowest instability in first time periods was noticed highest instability during the second period and it noticed second lowest instability district during third time period. (*See Table No 4.5*)

Production Instability in Barley across the Districts

Barley showed medium in Jind, Ambala, Gurgaon, Sirsa and Faridabad while high instability in Hisar, Mahendragarh, Kurukshetra, Karnal, Rohtak and Sonepat during first period, there was no district which registered low instability in the case of barley during first period.

Table No: 4.6- Production Instability in Barley

Barley	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability			Sonepat	8.91		
			Bhiwani	9.40		
			Mahendragarh	9.60	Karnal	6.96
			Jind	13.63	Jind	11.83
			Ambala	13.93		
Medium Instability	Jind	22.74	Sirsa	18.72	Ambala	16.73
	Gurgoan	22.92	Karnal	20.19	Sonepat	22.72
	Ambala	23.52	Gurgoan	23.33	Mahendragarh	24.12
	Bhiwani	26.08	Hisar	25.33		
	Sirsa	28.51				
	Faridabad	29.77				
High Instability	Hisar	33.66	Kurukshetra	-	Sirsa	36.97
	Mahendragarh	36.63	Rohtak	-	Hisar	37.63
	Kurukshetra	38.52	Faridabad	-	Gurgoan	38.71
	Karnal	40.4			Rohtak	-
	Rohtak	53.11			Kurukshetra	-
	Sonepat	59.12			Faridabad	-
					Bhiwani	-
Haryana	Barley	20.64	Barley	11.02	Barley	12.55

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08

Jind showed medium instability, followed by this Gurgoan, Ambala, Bhiwani, Sirsa and Faridabad during first period. Whereas, Hisar showed high instability followed by this Mahendragarh, Kurukshetra, Karnal, Rohtak and Sonepat during this period, while at all Haryana level it registered medium instability. The major changes take place in case of Sonepat and Mahendragarh during the 1990s which registered high instability during first period became low instability crops during second time period. At all Haryana level the instability of barley is declining continuously and it became low instability crops during second and third time period. Karnal and Jind showed low instability during 2000-01 to 2006-07.

Production Instability in Gram across the Districts

The condition of instability in Haryana was the worst in the case of gram since 1980-81. Not one district has been registered in low instability in all the time period. Karnal was the only district which recorded medium instability during 1980-81 to 1989-90, except this district all districts showed high instability during first time period.

Jind registered the highest instability during this time period. However, the instability of gram improved in some district but it was still high in all the districts. Mahendragarh, which registered the high instability during the first time period, decreased and was registered with medium instability during 2000-01 to 2006-07.

Table No: 4.7- Production Instability in Gram

Gram	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability						
Medium Instability	Karnal	29.86	Sirsa	13.90	Mahendragarh	22.51
			Gurgoan	16.75	Gurgoan	26.15
			Bhiwani	19.87	Rohtak	26.74
			Karnal	23.49	Hisar	29.1
			Ambala	26.09	Sirsa	29.42
			Sonepat	26.35		
			Rohtak	28.16		
High Instability	Mahendragarh	32.86	Jind	30.38	Bhiwani	36.67
	Ambala	33.18	Hisar	32.78	Kurukshetra	-
	Sirsa	34.05	Mahendragarh	36.37	Karnal	-
	Kurukshetra	35.88	Faridabad	45.78	Sonepat	-
	Sonepat	37.39	Kurukshetra	47.98	Faridabad	-
	Gurgoan	39.05			Jind	-
	Faridabad	40.08				
	Hisar	42.92				
	Rohtak	44.63				
	Bhiwani	66.09				
	Jind	66.37				
Haryana	Gram	42.98	Gram	34.34	Gram	30.30

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-0)8)

4.8-Production Instability in Rape seed and Mustard across the Districts

Rapeseed and mustard registered medium instability at all Haryana level during all the time periods. Sonepat was the only district which registered low instability during 1980-81 to 1989-90. There were four districts which showed high instability during 1980-81 to 1989-90. During nineties the condition of instability in some districts like, Sirsa, Faridabad, Jind, and Bhiwani improved and they showed low instability during this time period. One point to be noticed here has that the instability declined only in those districts which are rain-fed areas.

Table No: 4.8- Production Instability in Rape Seeds and Mustard

	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability	Sonepat	14.68	Sirsa Faridabad Jind Bhiwani	8.71 11.30 12.01 14.69	Bhiwani	5.1
Medium Instability	Mahendragarh Hisar Rohtak Sirsa Gurgoan Jind Faridabad	17.08 23.14 23.43 23.77 26.19 27.72 28.84	Gurgoan Hisar Sonepat Mahendragarh Rohtak	17.37 17.37 20.66 27.29 28.83	Kurukshetra Rohtak Jind Ambala Mahendragarh Karnal	15.88 17.41 19.18 21.37 23.08 26.15
High Instability	Karnal Kurukshetra Ambala Bhiwani	32.8 35.57 37.19 37.52	Ambala Karnal Kurukshetra	34.12 35.85 39.82	Hisar Faridabad Gurgoan Sirsa Sonepat	31.79 35.09 35.58 36.07 37.17
Haryana	RP seed*	18.41	RP seed*	16.48	RP seed*	18.91

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

Table No: 4.9- Production Instability in Cotton

	1980-81 to 1989-99		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability						
Medium Instability	Hissar Sonepat Rohtak Ambala Bhiwani	15.94 17.82 19.33 29.22 22.35	Sirsa Hissar karnal Mahendergargh	17.82 19.33 22.35 29.22	Rohtak Sirsa Hissar Jind Bhiwani	15.87 22.78 23.20 23.55 26.38
High Instability	Kurukshetra Jind karnal Sirsa Faridabad Gurgoan Mahendergargh	31.79 33.04 34.09 42.23 - - -	Jind Faridabad Bhiwani Kurukshetra Sonepat Rohtak Gurgoan Ambala	31.79 33.04 34.09 42.23 - - - -	Kurukshetra Sonepat Mahendergargh karnal Faridabad Gurgoan Ambala	30.29 39.78 50.51 - - - -

Production Instability in Total Cotton across the Districts

Total cotton shows Medium and high instability in all the districts, over the time period. Its main reason was that it is a kharif crop and there is high fluctuation in its area. If in any time period, rainfall is good and monsoon comes on time than area shifted towards rice. That is why there is lot of variation in its production and it make the reason of medium and high production instability. The result shows that production instability is comparatively low in rainfed districts like, Hisar, Sirsa, Bhiwani and Rohtak over the periods. It is comparatively high in well irrigated district like, Karnal and Kurukshetra.

Production Instability in Sugarcane across the Districts

Sugarcane showed declining trend in instability, it registered low instability at all Haryana level and declining continuously in all the time periods. During the first time period, there were two districts, Sonepat and Kurukshetra which registered low instability but during the 1990s both districts underwent high instability.

Table No: 4.10- Production Instability in Sugarcane

Sugarcane	1980-81 to 1989-90		1990-91 to 1999-2000		2000-01 to 2006-07	
Low Instability			Bhiwani	6.29	Ambala	4.01
			Hisar	9.20	Karnal	6.89
	Sonepat	14.79	Sirsa	12.68	Faridabad	8.31
					Kurukshetra	9.31
	Kurukshetra	14.93			Sonepat	13.33
Medium Instability	Karnal	15.42	Jind	18.94	Rohtak	15.66
	Ambala	20.19	Rohtak	27.87	Jind	20.83
	Rohtak	20.64			Hisar	28.9
	Faridabad	29.67			Sirsa	29.55
	Jind	29.82				
High Instability	Hisar	35.18	Mahendragarh	31.72	Bhiwani	50.7
	Bhiwani	55.88	Kurukshetra	35.51	Gurgoan	-
	Gurgoan	86.27	Sonepat	40.52	Mahendragarh	-
	Mahendragarh	-	Ambala	-		
	Sirsa	-	Karnal	-		
			Faridabad	-		
			Gurgoan	-		
Haryana	Sugarcane	12.15	Sugarcane	11.78	Sugarcane	10.55

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

There were five districts which registered high instability during the first time period. Whereas in the 1990s there were seven districts, Mahendragarh, Kurukshetra, Sonepat, Ambala, Karnal, Faridabad, and Rohtak, which showed high instability, the major change took place in Ambala, which showed high instability during the 1990s, but underwent low instability district during 2000-01 to 2006-07. Ambala, Karnal, Faridabad, Kurukshetra and Sonepat showed declining trend in instability since 1990-91, and changed to become low instability districts in sugarcane. Bhiwani, which registered the lowest instability by 6.29 during the 1990s became the highest instable (50.7) district during 2000-01 to 2006-07. (*See Table No 4.10*)

In brief, instability is declining in almost crops however it relatively more declined in rice wheat and sugarcane. These three crops registered low instability over the periods. The reason behind it is that the area under rice and wheat is increasing due to crop diversification over the period therefore production of these crops is increasing. That is why; there is low variability in the production of these crops. In the case of sugarcane, the area and production shows a linear growth, there is no high variation in its production. That is why the instability is low in all these crops over the period.

In other crops like gram, bajra, moong , massar, seesamum, Barley and maize, there is high variation in their production. Due to crop diversification area under these crops declined so that the production is also declined. In the case of Cotton the instability lies between low and medium, it main reason is variability in area and production under cotton. During eighties Desi cotton registered lower instability than American, while during nineties instability is low in American cotton than Desi cotton. The reason behind it is adopting (HYV) seed in American cotton. The productivity increased relatively more in the case of American cotton than Desi cotton.

Crop Diversification in Haryana

As mentioned previously, crop diversification implies a shift from single crop farming to multiple crop farming, from subsistence farming to commercial farming or from low value food crops to high value food or non-food crops. The level of crop diversification largely depends upon the agro climatic/socio-economic condition and technological development in the region. There are many reasons of crops diversification; to enhance the farm efficiency is most important all of them. In present time the size of land holding is declining continuously, to enhance the efficiency of small farm, the farmer is diversifying from low value crops to high value crops. Even in the case of Haryana, where land is very fertile and there is lot of scope to enhance the farm efficiency, the resources are diversifying towards high value crops since 1980-81.

There are many methods to measure crop diversification. Among them some important methods are, Herfindal index, Index of maximum proportion, Entropy Index and Simpson Index, etc. Here we have use Herfindal Index for measure the diversification.

Herfindahl index is defined as:

$HI = \sum si^2$

Where si = the share of area of i^{th} crop of Gross Cropped Area, $si = Yi / Y$

Where Yi is the area of i^{th} crop and Y is Gross Cropped Area

The value of HI lies between 0 and 1. It indicates that the lower value of HI shows more diversification, while the higher value show relatively more specialization of a few crops.

The table 4.2.1 shows that in the first period (1980-81) Karnal, Kurukshetra, Bhiwani are relatively specialized districts with value by 0.30, 0.30, and 0.28, respectively. In the same period, Hissar (0.16), Jind (0.17), Rohtak (0.18), Ambala (0.19) and Sirsa (0.19) became highly diversified districts with relatively lower value. In second period i.e. 1985-86, Karnal, Kurukshetra, and Sonepat show a relatively higher value than the first period. In the final period (2006-07) Rohtak (0.21), Hissar (0.22), Mahendragarh (0.24) and Bhiwani (0.24) shows more diversified districts with relatively lower value of HI. Whereas Karnal (0.380, Kurukshetra (0.36), Faridabad (0.32) and Sonepat show relatively specialized districts with a greater value of HI.

Table No: 4.2.1 - District-wise Crop Diversification Index – 1980-81 to 2006-07

	1980-81	1985-86	1990-91	1995-96	2000-01	2006-07
	H.I	H.I	H.I	H.I	H.I	H.I
Ambala	0.19	0.20	0.22	0.23	0.27	0.27
Karnal	0.30	0.32	0.31	0.32	0.37	0.38
Kurukshetra	0.30	0.33	0.34	0.39	0.38	0.36
Rohtak	0.18	0.18	0.21	0.19	0.25	0.21
Sonepat	0.26	0.31	0.30	0.29	0.33	0.31
Faridabad	0.25	0.26	0.27	0.29	0.32	0.32
Jind	0.17	0.21	0.20	0.21	0.28	0.27
Mahindergarh	0.26	0.21	0.26	0.25	0.26	0.24
Bhiwani	0.28	0.25	0.20	0.21	0.19	0.24
Gurgaon	0.21	0.20	0.23	0.24	0.30	0.30
Hisar	0.16	0.16	0.19	0.18	0.23	0.22
Sirsa	0.19	0.18	0.20	0.20	0.24	0.26
Haryana	***0.154***	***0.164***	***0.165***	***0.17+***	***0.21+***	***0.19+***

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08), + value shows HI value

In the first period, we find that there were two districts, Karnal and Kurukshetra, which were more specialized with higher value 0. 3 or greater than 0.3 (HI=0.3 or HI >0.3). Except Karnal and Kurukshetra all districts showed more diversified with lower HI value.

However, the degree of HI is increased in all districts from first period to last period (2006-07) except Bhiwani and Mahendragarh. In Bhiwani and Mahendragarh HI shows declining or constant trend, which indicates that in these districts there is high diversification. At state level the degree of HI is increasing, which shows relatively more specialition in a few crops like rice, wheat and cotton.

The study analyse that during 1980's, the area was found in all the crops, but with the passage of time, only a few crops such as Wheat, Rice, Cotton and Rape seed and Mustard shows a increasing trend while area under other crops like Gram, Bajra, Jawar, Maize, Moong, Massar, and Sesamum registered a decreasing trend. The table shows that in Haryana during 1980-81 to 1990-91 all types of corps were grown but with the passage of time, crop diversification took place.

Table No: 4.2.2 - Percentage area under different crops and Herfindahl Index in Haryana (G.C.A. = Gross Cropped Area)

Area under crops in 000 hectares and G.C.A.				% Area and HI		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	484	661.2	1040	8.86	11.17	15.58
Jowar	136	129.4	90	2.49	2.19	1.35
Bajra	881	609	621	16.13	10.29	9.30
Maize	74	34.8	15	1.35	0.59	0.22
Wheat	1476	1850	2380	27.02	31.26	35.66
Barley	120	50.5	33	2.20	0.85	0.49
Gram	720	649.3	110	13.18	10.97	1.65
Moong	4.2	10.7	21	0.08	0.18	0.31
Masoor	23	18.3	3.8	0.42	0.31	0.06
RP Seed*	299	473	707.8	5.47	7.99	10.61
Sesamum	2	6.1	4	0.04	0.10	0.06
Cotton	316.2	490.6	584	5.79	8.29	8.75
Sugar cane	115	147.8	140	2.11	2.50	2.10
Other	811.6	788.3	924.4	14.86	13.32	13.85
G.CA.	***5462***	***5919***	***6674***	***0.15+***	***0.16+***	***0.19+***

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08), + value shows HI value

RP Seed* = Reap Seed and mustard

Table 4.2.2 shows the percentage area for crops in different time periods. The study analysis that area was shifting towards rice, wheat and cotton due to crop diversification and crop specialization in Haryana. The area under Rice was 8.86% in 1980-81 which increased to 15.58% in 2006-07, and area under Wheat was 27.02% in 1980-81 which increased 35.66% in 2006-07. Cotton and Rape Seed and Mustard also showed increasing trends. On the other hand, except these crops (Rice, Wheat, Cotton, Rape seed and Mustard) all crops have registered a declining trends. The most important point is to be notice here is that, the area under Gram was 13.18% in 1980-81, which registered only 1.65% in 2006-07, and area under Bajra was 16.30% in 1980-81 that registered 9.30% in 2006-07. This type of trend in area showed the diversification of some crops to other crops. We discuss this topic broadly in the districts level study.

4.2.3 - Percentage area under different crops and Herfindahl Index in Ambala

The area in Ambala was found in almost the crops in 1980-81. The area under Rice was 17.37%, Bajra (1.17%), Maize (9.87%), Wheat (29.7%), Gram (3.44%), Massar (1.9%), Sugarcane (7.13%), and other crops 23.63% in 1980-81. The area under different crops has seen lot of changing during 1980-81 to 2006-07. The area under a few crops like Rice, Wheat and Sugarcane showed an increasing trend, while the share of area under all the crops except Rice, Wheat and Sugarcane showed a continuous decline. The degree of HI showed an increasing trend during 1980-81 to 2006-07. It showed that Ambala in moving toward relatively more crop specialized from 1980-81 to 2006-07. The share of area under different crops showed the same trend. It showed that some crops like Rice, Wheat, and Sugarcane getting more specialized during 1980-81 to 2006-07, while the area under all the corps except rice wheat and sugarcane in diversifying into other crops. The most important change that took place was in the case of Maize and Gram, the share of area under Gram declined from 3.44% to 0.19% followed by Maize from 9.87% to 3.43% in 1980-81 to 2006-07.

The share of area under both Rice and Wheat was 47% in 1980-81, which increased 68% in 2006-07. It shows that the area under both crops was one half of total cropped area in 1980-81 which increased $3/4^{th}$ of total cropped area in 2006-07. The degree of HI was 0.19 in 1980-81 which increased 0.27 in 2006-07, showed more crop specialization during this period.

Table No: 4.2.3 - Percentage area under different crops and Herfindahl Index in Ambala

Area under crops in 000 hectares and G.C.A.				% Area and HI		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	65.3	102.7	142.3	17.37	22.77	30.73
Jowar	0.2	0.20	-	0.05	0.04	-
Bajra	4.4	2.00	1.9	1.17	0.44	0.41
Maize	37.1	25.10	15.9	9.87	5.57	3.43
Wheat	111.8	150.60	172	29.73	33.39	37.15
Barley	3.3	1.80	0	0.88	0.40	-
Gram	12.95	3.70	0.9	3.44	0.82	0.19
Moong	-	-	0	-	-	-
Masoor	7.15	5.30	3.1	1.90	1.18	0.67
RP Seed*	7.2	0.40	2.4	1.91	0.09	0.52
Sesamum	0.5	5.50	0.2	0.13	1.22	0.04
American	0.3	-	0	0.08	-	-
Desi	3.7	5.60	0	0.98	1.24	-
Sugar cane	26.8	55.10	54.2	7.13	12.22	11.71
Other	88.85	93.00	70.1	23.63	20.20	15.14
G.C.A.	**376**	**451.00**	**463**	**0.191**$^{+}$	**0.223+**	**0.270+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08), + value shows HI value

RP Seed* = Reap Seed and mustard

4.2.4 - Percentage area under different crops and Herfindahl Index in Karnal

Progress of crop diversification in Karnal:- Changing in cropping pattern of Karnal during 1980-81 to 2006-07 is shown in table 4.4. The table showing that only two crops, Wheat and Rice have gained pre-eminence in the cropping pattern from the last two decades, whereas all the other crops like Jawar, Bajra, Maize, Cotton and all types of pulses have been marginalized in the cropping pattern. The table 4.4 showed that the degree of HI is increasing trend which showed that only a few crop gained relatively specialization during the period. The share of area under different crops shifted toward only Rice and Wheat. The share of area under Rice and Wheat were 30% and 42.3% in 1980-81, which increased 41.4% and 43.9% in 2006-07. It means that area under both Rice and Wheat was 72% in 1980-81 which increased 84% in 2006-07. We calculated the area other than these corps which we analyse in this study also. The area in other crops, like vegetables

and some other crops which we do not include in this study shows an increasing trend from 1980-81 to 1995-96 but it showed a marginalized decline.

Table No: 4.2.4 - Percentage area under different crops and Herfindahl Index in KARNAL

Area under crops in 000 hectares and G.C.A.				% Area and HI		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	148.1	192	239.8	29.98	29.68	41.49
Jowar	3.2	1.10	0.3	0.65	0.17	0.05
Bajra	7.4	2.90	1.8	1.50	0.45	0.31
Maize	11.9	3.10	0.3	2.41	0.48	0.05
Wheat	209.2	241.80	254.1	42.35	37.37	43.96
Barley	3.1	0.70	0.1	0.63	0.11	0.02
Gram	4.4	1.30	0.3	0.89	0.20	0.05
Moong	0.1	0.10	0.1	0.02	0.02	0.02
Masoor	3.75	1.80	0.3	0.76	0.28	0.05
RP Seed*	2.8	0.10	0.8	0.57	0.02	0.14
Sesamum	0.15	2.20	0.1	0.03	0.34	0.02
American	2.15	0.10	0.1	0.44	0.02	0.02
Desi	2.9	1.00	0	0.59	0.15	-
Sugar cane	15	16.70	18.3	3.04	2.58	3.17
Other	79.85	182.10	61.6	16.16	28.15	10.66
G.C.A.	494	647.00	578	**0.29+**	**0.30+**	**0.37+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Reap Seed and mustard

The share of area under other crops like vegetables was 16.16% in 1980-81, which showed an increasing trend till 1995-96 it registered a declining trend and which showed only 10.6% in 2006-07.

4.2.5 - Percentage area under different crops and Herfindahl Index in Kurukshetra

Kurukshetra experienced the same trend of cropping pattern. It is seen that the share of area was favor in Rice and Wheat in 1980-81 and it registered more favour in Rice and wheat in recent years. The share of area under both Rice and Wheat was 74.5% in 1980-81, which increased 83.5% in 2006-07. The degree of HI has registered an increasing trend which showed some specialization of some crops like Rice and Wheat. The degree

of HI was 0.30 in 1980-81 which showed an increasing trend until 2000-01 it registered 0.38 in 2000-01. In 2006-07 it noticed 0.36 some declining trend.

Other than Rice and Wheat, the share of area noticed a declining trend in almost all the time period. The share of area under Maize showed marginal declining trends it declined from 2.19% to 0.05% from 1980-81 to 2006-07 followed by Jawar from 0.58% to 0.02%, Gram from 1.02% to 0.05% and Barley from 0.88% to 0.02% in the same time period. The share of area under sugarcane lays the trend in all time period.

The one point is to be notice here is that during nineties, the share of area and Rice and Wheat was sharply declined and the share of other crops like all vegetable [in the crops column, listed as "other"] was sharply increased. The share of area declined from 32.1% to 20.6% and from 44.1% to 26.3% in Rice and Wheat respectively from 1980-81 to 1990-91, and the share of area under other crops has sharply increased from 14.3% to 47.3% in the same time period.

Table No: 4.2.5 - Percentage area under different crops and Herfindahl Index in Kurukshetra

Area under crops in 000 hectares and G.C.A.				**% Area and HI**		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	172	192	261.4	32.15	20.69	40.28
Jowar	3.1	2.3	0.1	0.58	0.06	0.02
Bajra	7.4	17.2	11.9	1.38	1.12	1.83
Maize	11.7	7.4	0.3	2.19	0.24	0.05
Wheat	226.2	183	282	42.28	26.38	43.45
Barley	4.7	1.2	0.1	0.88	0.09	0.02
Gram	5.45	2.7	0.3	1.02	0.22	0.05
Moong	0.1	0.1	0.2	0.02	0.01	0.03
Masoor	3.6	2.1	0.6	0.67	0.22	0.09
RP Seed*	4.4	6.5	0.8	0.82	0.03	0.12
Sesamum	0.25	0.5	0.1	0.05	1.50	0.02
American	2.3	5.3	2.6	0.43	0.29	0.40
Desi	5.15	4.7	1.4	0.96	0.24	0.22
Sugar cane	12	14.3	1.4	2.24	1.54	2.43
Other	76.65	177.7	15.8	14.33	47.37	11.00
G.C.A.	**535**	**617**	**638**	**0.30+**	**0.33+**	**0.36+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Reap Seed and mustard

4.2.6 - Percentage area under different crops and Herfindahl Index in Sonepat:

In Sonepat there was a different cropping trend during 1980-81 to 2006-07. In 1980-81 the area was devoted in all the crops. The share of area under Jawar and Bajra was higher than the share of area of Rice in 1980-81, while the area under wheat followed the same constant trend. It lies between 45-51 percent during the whole period. The most important changes took place in case in Rice, Jawar and Bajra. Rice sharply gained in its area and it increased from 6.96% to 24% from 1980-81 to 2006-07, while Bajra sharply declined in its area from 8.6% to 2.2% from the same time period. Sugarcane follows the almost constant trend during the whole period. Its share of area lies between 3% to 5%. Rice is the only crop which recorded a sharply increment in its area. The degree of HI showed an increasing trend, it increased from 0.26 to 0.31 from 1980-81 to 2006-07.

One point is to be noticeable here is that the area under crops was diversifying towards Rice only and Jawar, Bajra registered declined in their area.

Percentage area under different crops and Herfindahl Index in Rohtak

Rohtak is the district, in which degree of HI showed a marginal change. The degree of HI was 0.182 in 1980-81 it increased to 0.20 in 2006-07. Area under Rice is not higher in Rohtak like other districts. Jawar, Bajra, Wheat and Gram were the major crop in Rohtak in 1980-81 while Rice was a marginal crop in Rohtak. The share of area under Rice was only 0.73%in 1980-81 while the share of Bajra, Jawar, Wheat and Gram was 20.3%, 10.5%, 30.8% and 14.01% in the same time period.

The share of area under Wheat, Rice and Rape seed and Mustard showed an increasing trend while the share of area under Gram and Bajra registered a sharply declined trend.

When we analysis our results we find that the area under different crops is diversify one crop to another crops. However these types of diversification has positive trend in some crops like Rice, Wheat, Rape seed and Mustard, while it noticed negative trend in Bajra, Gram and Barley during the study period. The degree of HI showed a marginal increasing trend during the study period. It increased from 0.18 to 0.20 from 1980-81 to 2006-07, which explain about the marginal increasing trend of diversification.

Table No: 4.2.6 - Percentage area under different crops and Herfindahl Index in Sonepat

Area under crops in 000 hectares and G.C.A.				**% Area and HI**		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	18.3	19.9	71.5	6.96	12.44	23.99
Jowar	23.1	9.50	13.2	8.78	5.94	4.43
Bajra	22.5	3.40	7	8.56	2.13	2.35
Maize	3.8	0.90	0.6	1.44	0.56	0.20
Wheat	121.6	80.50	142	46.24	50.31	47.65
Barley	3.1	0.40	0.8	1.18	0.25	0.27
Gram	4.95	1.30	0.2	1.88	0.81	0.07
Moong	0.2	-	0.2	0.08	-	0.07
Masoor	0.8	0.10	-	0.30	0.06	-
RP Seed*	4.7	-	0.1	1.79	-	0.03
Sesamum	-	9.60	0.1	-	6.00	0.03
American	0.6	0.20	2	0.23	0.13	0.67
Desi	3.75	1.60	0.2	1.43	1.00	0.07
Sugar cane	12.5	6.90	12.8	4.75	4.31	4.30
Other	43	25.70	47.3	16.35	16.06	15.87
G.C.A.	263	160.00	298	**0.26+**	**0.30+**	**0.31+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Reap Seed and mustard

Table No: 4.2.7 - Percentage area under different crops and Herfindahl Index in Rohtak

Area under crops in 000 hectares and G.C.A.				% Area and HI		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	3.2	9.7	35	0.73	1.99	7.56
Jowar	46.2	57.50	49	10.50	11.81	10.58
Bajra	89.5	48.10	40.6	20.34	9.88	8.77
Maize	0.4	0.30	0.2	0.09	0.06	0.04
Wheat	132.8	185.50	173	30.18	38.09	37.37
Barley	10.5	6.60	2.1	2.39	1.36	0.45
Gram	61.65	14.10	2.9	14.01	2.90	0.63
Moong	0.1	-	0.1	0.02	-	0.02
Masoor	0.25	0.10	0	0.06	0.02	-
RP Seed*	14.65	0.20	55.1	3.33	0.04	11.90
Sesamum	0.15	77.60	0.1	0.03	15.93	0.02
American	4.4	6.40	9.8	1.00	1.31	2.12
Desi	3.75	1.60	6.7	0.85	0.33	1.45
Sugar cane	18.7	26.20	13.8	4.25	5.38	2.98
Other	53.75	53.10	74.6	12.22	10.90	16.11
G.C.A.	440	487.00	463	**0.18+**	**0.21+**	**0.20+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) *+ value shows HI value*

RP Seed* = Reap Seed and mustard

Percentage area under crops and Herfindahl Index in Faridabad

The gross cropped area in Faridabad has recorded a declined trend. The gross cropped area in Faridabad declined from 244 thousand hectare from 1980-81 to 2006-07. It showed that area under crops is diversified toward non-cropped area. As we know, Faridabad is an advanced district in industrialization. Agricultural land is diversified towards industrial and housing land. The area under crops is diversified from coarse cereals to other crops. The area under Rice, Wheat and other crops ["others" means those area which we do not included in this study except fifteen crops] is increasing continuously from last two decade.

Table No: 4.2.8 - Percentage area under different crops and Herfindahl Index in Faridabad

Area under crops in 000 hectares and G.C.A.				**% Area and HI**		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	2.5	7.7	26.4	1.02	3.21	12.05
Jowar	16.8	22.80	10.3	6.89	9.50	4.70
Bajra	43.9	24.60	8.7	17.99	10.25	3.97
Maize	2	1.9	0.2	0.82	0.79	0.09
Wheat	102.7	111.9	104.5	42.09	46.63	47.72
Barley	16.5	4.90	1.2	6.76	2.04	0.55
Gram	3.35	0.50	-	1.37	0.21	-
Moong	0.55	0.10	2.3	0.23	0.04	1.05
Masoor	1.65	0.60	-	0.68	0.25	-
RP Seed*	6.4	0.90	0.3	2.62	0.38	0.14
Sesamum	1.6	25.70	0.3	0.66	10.71	0.14
American	0.75	0.20	0.3	0.31	0.08	0.14
Desi	0.4	-	-	0.16	-	-
Sugar cane	5.7	9.00	5.2	2.34	3.75	2.37
Other	39.2	29.20	59.3	16.07	12.17	27.08
G.C.A.	244	240.00	219	**0.24+**	**0.26+**	**0.32+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) . + value shows HI value

RP Seed* = Reap Seed and mustard

Table 4.7 showed that the area under coarse cereals is shifting towards Rice, Wheat and vegetables. Bajra recorded the highest declining trend, the area under Bajra declined from 44 thousand hectares to 8.7 thousand hectares from 1980-81 to 2006-07. The degree of HI has recorded increasing trend from 1980-81 to 2006-07 continuously. It increased from 0.24 to 0.32 which showed that a few crops gained relatively in specialization with the passage of time. One point which is noticeable here is that, the area under which we included in 'other' is increasing continuously. It shared increased from 16% to 27% from 1980-81. The main reason is that Faridabad is an industrial-based city and it is near the national capital region. That is why there is a high demand of vegetables which gives more profit to farmers so that the cropping pattern diversifies from coarse cereals to Wheat, Rice and Vegetables.

Percentage area under different crops and Herfindahl Index in Gurgaon

The gross cropped area in Gurgaon is increasing continuously from 1980-81. The gross cropped area increased from 272 thousand hectares to 343 thousand hectare from 1980-81 to 2006-07.

Table No: 4.2.9 -Percentage area under different crops and Herfindahl Index in Gurgaon

Area under crops in 000 hectares and G.C.A.				% Area and HI		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	0.4	1.6	10.8	0.15	0.63	3.15
Jowar	21.1	22.80	11.6	7.76	8.94	3.38
Bajra	69.7	54.00	78	25.63	21.18	22.74
Maize	0.2	-	-	0.07	-	-
Wheat	92.1	98.10	138	33.86	38.47	40.23
Barley	22.1	9.10	3.7	8.13	3.57	1.08
Gram	21.05	8.90	0.9	7.74	3.49	0.26
Moong	0.1	0.10	0.1	0.04	0.04	0.03
Masoor	0.7	0.30	1	0.26	0.12	0.29
RP Seed*	22.1	1.20	0.6	8.13	0.47	0.17
Sesamum	0.15	37.10	0.6	0.06	26.31	0.17
American	-	-	0.1	-	-	0.03
Desi	-	0.10	0.1	-	0.04	0.03
Sugar cane	0.7	0.40	0.7	0.26	0.16	0.20
Other	21	21.30	96.8	7.72	8.04	28.22
G.C.A.	272	255.00	343	**0.21+**	**0.23+**	**0.29+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Reap Seed and mustard

Gurgaon is well-industrialized city in Haryana and nearby Delhi. The trend of crops diversification is same different in Gurgaon. In other districts the area has shifted from coarse cereals to Rice and Wheat, but in Gurgaon it has shifted to Wheat and those crops that we do not included in the study. We studied fifteen crops here and the area that is not in this study is calculated in 'other crops

We find that the area under Gram, Reap seeds and Mustard, Barley and Jawar declined from 21 thousand hectares to 0.9 thousand hectares, from 22 thousand hectares to 0.6 thousand hectares, 22.07 thousand hectares to 3.7 thousand hectares and 21 thousand hectares to 11.6 thousand hectares, respectively, from 1980-81 to 2006-07. While the area under Rice, Wheat and those areas which is other than fifteen crops is increasing continuously. It showed that the area is shifted from coarse cereals to wheat and vegetables. The area under other crops except fifteen studied crops is increased from 21 thousand hectares to 96.8 thousand hectares. The trend of HI recorded an increasing trend, it increased from 0.21 to 0.29 from 1980-81 to 2006-07, it showed that a few crops gained more specialization during 1980-81 to 2006-07.

Percentage area under different crops and Herfindahl Index in Mahendragarh

The area under crops in Mahendragarh has been diversifying from 1980-81. The degree of HI showed a declining trend, which showed that the area is diversifying to other crops. The degree of HI declined from 0.26 to 0.23 from 1980-81 to 2006-07.

Mahendragarh is a rain fed area and has a lack of irrigation facilities due to a very low level of ground water, which is why there area under Rice is very low.

The level of ground water is declining continuously year to year. In this district, the area has shifted in those crops in which there is low demand of water. However, the area under

Bajra is declining continuously, yet its share of gross cropped area is still high. The area under Gram declined from 54.8 thousand hectares to 8.3 thousand hectares from 1980-81 to 2006-07. Its share of gross cropped area declined from 44% to 32% from 1980-81 to 2006-07. The area under Wheat registered a marginal declining from 17.8% to 16.9% from 1980-81 to 2006-07, however the area under Wheat has increased in percentage area while Rice decreased in the same period.

Percentage area under different crops and Herfindahl Index in Bhiwani

In Bhiwani there is a lack of irrigation facilities so that the area to diversifying in those crops which have low requirement of irrigation facilities. The concentration of crops declined from 1980-81 to 1990-91. After that it increased in 2006-07. This indicates that in 1990-91 more diversification took place while in 2006-07 it registered an increased that indicated more specialization of some crops.

Table No: 4.2.10 - Percentage area under different crops and Herfindahl Index in Bhiwani

Area under crops in 000 hectares and G.C.A.				**% Area and HI**		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	0.2	0.1	12.5	0.03	0.02	1.58
Jowar	5.4	1.90	3.2	0.86	0.31	0.40
Bajra	254.5	184.30	222.5	40.65	29.82	28.09
Maize	0.3	0.10	0.1	0.05	0.02	0.01
Wheat	42.8	59.30	118.6	6.84	9.60	14.97
Barley	9.9	3.20	4.9	1.58	0.52	0.62
Gram	194.15	95.10	81.7	31.01	15.39	10.32
Moong	2.25	2.00	4.8	0.36	0.32	0.61
Masoor	0.2	0.10	-	0.03	0.02	-
RP Seed*	19.2	0.10	0.2	3.07	0.02	0.03
Sesamum	0.3	103.50	0.2	0.05	16.75	0.03
American	15.35	24.10	49.1	2.45	3.90	6.20
Desi	4.9	1.80	11.4	0.78	0.29	1.44
Sugar cane	2.8	1.10	1.7	0.45	0.18	0.21
Other	73.75	141.30	281.1	11.78	22.86	35.49
G.C.A.	**626**	**618.00**	**792**	**0.28+**	**0.20+**	**0.24+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Reap Seed and mustard

The concentration of crops declined by 0.28 to 0.20 from 1980-81 to 1990-91; after that it increased from 0.20 to 0.24 in 2006-07. The area under coarse cereals declined but it has been dominant until 2006-07. The area under Bajra declined from 254 thousand hectares to 184 thousand hectares from 1980-81 to 1990-91 but after that it increased from 184 thousand hectares to 222 thousand hectares from 1990-91 to 2006-07. The share of area and Bajra has been decreasing continuously from 1980-81; it declined from 40% to 29% from 1980-81 to 1990-91 but showed a marginal decline from 29.8% to 28% from 1990-91 to 2006-07. The share of both Bajra and Gram was 70% in 1980-81 it became only 46% in 1990-91 and it noticed 38% in 2006-07. The share of both crops sharply declined during the study periods. Even the area under Bajra showed a marginal declined from 1980-81 to 2006-07 due to increased in cross-cropped area from 1980-81 to 2006-07. The share of area under Bajra, Jawar, Reap seed and Mustard and Gram declined while the share of area under Wheat, American Cotton and area under other crops, except the fifteen crops in this study, has increased.

Percentage area under different crops and Herfindahl Index in Jind

The area in Jind for rice wheat, Bajra and Gram is seen to be more diversifying. The area shifted from coarse cereals to staple crops. Area under rice and wheat increased in all the time periods, while area under Bajra, Gram, Jowar, and Sugarcane declined in all the time periods.

The area under both rice and wheat increased to 35%, 47.7% and 64.1% during 1980-81, 1990-91 and 2006-07, respectively. On the other hand, the share of Jowar, Bajra and Gram declined by 31.5%, 15.7% and 10.3% in 1980-81, 1990-91 and 2006-07, respectively. The area shift higher towards wheat; it increased by 27% to 43.5% from 1980-81 to 2006-07. Whereas the higher shift from the area of Gram; it declined by 12.8% to 0.15% from 1980-81 to 2006-07. The area shift towards rice;itincreased by 35.3 thousand hectare to 96 thousand hectare. While the area under Bajra declined from 73.8

thousand hectare to 46.8 thousand hectare followed by Gram from 57.2 thousand hectare to 0.7 thousand hectare from 1980-81 to 2006-07.

Percentage area under different crops and Herfindahl Index in Hisar

The concentration of area under crops increased during 1980-81 to 2006-07. It showed that some crops gained more specialization during the study period. The share of area under rice, wheat is increasing during the study period while the share of area under all crops except rice, wheat and American cotton declined during the study period. The area shifted towards rice from 18.7 thousand hectares to 103 thousand hectares followed by wheat from 155 thousand hectares to 382 thousand hectares and American cotton from 137.6 thousand hectares to 202 thousand hectares from 1980-81 to 2006-07.

The area under Bajra declined from 118.4 thousand hectares to 73 thousand hectares, followed by Gram from 190 thousand hectares to 24 thousand hectares and rape seed mustard from 42.5 thousand hectares to 10.6 thousand hectares from 1980-81 to 2006-07.

Percentage area under different crops and Herfindahl Index in Sirsa

In Sirsa, the area is diversifying towards wheat, American cotton and rice. It is shifting from Bajra, Gram, Barley; rape seed and mustard, maize and sugarcane. The area under American cotton increased from 77 thousand hectares to 140 thousand hectares and finally 159 thousand hectares in 1980-81, 1990-91 and 2006-07, respectively, followed by wheat by 97.3, 165.9 and 250 thousand hectares respectively in the same time period. On the other hand, the area under Bajra declined from 18.5 thousand hectares to 4.9 thousand hectares followed by Gram from 166.9 thousand hectares to 9.4 thousand hectares and reap seed mustard from 20.8 thousand hectares to 1.1 thousand hectares from 1980-81 to 2006-07.

Table No: 4.2.11 - Percentage area under different crops and Herfindahl Index in Jind

Area under crops in 000 hectares and G.C.A.				% Area and HI		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	35.3	43.2	96.7	7.93	10.64	20.57
Jowar	8.9	6.80	0.2	2.00	1.67	0.04
Bajra	73.8	46.70	46.8	16.58	11.50	9.96
Maize	1.4	0.10	-	0.31	0.02	-
Wheat	121.3	150.50	204.6	27.26	37.07	43.53
Barley	7	2.50	0.8	1.57	0.62	0.17
Gram	57.2	10.10	0.7	12.85	2.49	0.15
Moong	0.1	-	0.2	0.02	-	0.04
Masoor	3.95	1.30	-	0.89	0.32	-
RP Seed*	8.45	0.50	0.3	1.90	0.12	0.06
Sesamum	0.55	25.20	0.3	0.12	6.21	0.06
American	12.85	38.30	37.5	2.89	9.43	7.98
Desi	13.35	5.50	12.2	3.00	1.35	2.60
Sugar cane	13.2	11.50	3.6	2.9	2.83	0.77
Other	87.65	63.80	66.1	19.70	15.71	14.06
G.C.A. & HI	445	406.00	470	**0.16+**	**0.20+**	**0.26+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Rape Seed and mustard

Table No 4.2.12 - Percentage area under different crops and Herfindahl Index in Hisar

Area under crops in 000 hectares and G.C.A.				% Area and HI		
Rice	18.7	37.1	103.9	2.14	4.15	9.81
Jowar	3.8	0.70	-	0.43	0.08	-
Bajra	118.4	74.50	73	13.55	8.34	6.89
Maize	1.9	0.70	0.1	0.22	0.08	0.01
Wheat	155.2	256.20	382	17.76	28.69	36.07
Barley	9.2	6.60	7.7	1.05	0.74	0.73
Gram	190.9	97.10	24.2	21.84	10.87	2.29
Moong	0.6	3.40	8.2	0.07	0.38	0.77
Masoor	1.65	0.40	0.1	0.19	0.04	0.01
RP Seed*	42.25	0.20	10.6	4.83	0.02	1.00
Sesamum	0.15	100.90	0.6	0.02	11.30	0.06
American	137.6	226.90	202.7	15.74	25.41	19.14
Desi	38.2	16.00	39.7	4.37	1.79	3.75
Sugar cane	5.4	4.20	3	0.62	0.47	0.28
Other	149.7	68.10	203.2	17.17	7.60	19.19
GCA	874	893.00	1059	**0.15+**	**0.18+**	**0.22+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Rape Seed and mustard

Table No 4.2.12 - Percentage area under different crops and Herfindahl Index in Sirsa

Area under crops in 000 hectares and G.C.A.				% Area and HI		
CROPS	**1980-81**	**1990-91**	**2006-07**	**1980-81**	**1990-91**	**2006-07**
Rice	20	26.3	46	3.82	4.83	6.52
Jowar	-	0	-	-	-	-
Bajra	18.5	8.3	4.9	3.54	1.52	0.69
Maize	0.4	0.1	-	0.08	0.02	-
Wheat	97.3	165.9	250	18.60	30.44	35.41
Barley	6.8	5.6	5.5	1.30	1.03	0.78
Gram	166.9	55.4	9.4	31.91	10.17	1.33
Moong	0.5	0.3	1.6	0.10	0.06	0.23
Masoor	0.85	0.1	0.1	0.16	0.02	0.01
RP Seed*	20.8	0.1	1.1	3.98	0.02	0.16
Sesamum	-	61.8	1.1	-	11.34	0.16
American	77	140.1	159.1	14.72	25.71	22.54
Desi	33.95	35	33.5	6.49	6.42	4.75
Sugar cane	0.3	0.1	0.2	0.06	0.02	0.03
Other	79.55	45.9	193.5	15.21	8.39	27.41
HI	523	545	706	**0.19+**	**0.19+**	**0.25+**

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) + value shows HI value

RP Seed* = Rape Seed and mustard

In sum, the instability has been low and also declined over the time in wheat and rice. There are clear evidence of the crop diversification towards rice, wheat, cotton and other crops. The instability in Wheat, Rice and Sugarcane registered has been low, while in gram moong massar it has been high in all the periods. The result shows that the trend of instability is still high in many crops like gram, moong massar. Instability in Jowar has

declined sharply from 1980-81 to 2006-07. During eighties Jowar's production declined due to crop diversification, however being an animal feed it could not be ignored. That was why the production of jowar increased later and with this effect the instability declined and it became low instability crops during 2000-01 to 2006-07.On the other hand the instability is still high in pluses and coarse cereals because area under these crops is shifted towards rice and wheat and increased the instability of those crops.

District wise, it is found that the instability is low in wheat in all the districts over the time. The instability in Rice is also low however only in those districts which are relatively advance in agriculture e.g. Karnal, Kurukshetra. The instability in production of rice is declining in karnal, Kurukshetra, Ambala, Jind, Hisar, Sirsa and Faridabad throughout the study period. Gurgoan which recorded medium instability during first period has recorded highest instability during third period of time. It may be because larger part of Gurgaon lies in rainfed area, therefore instability of rice in increasing over the period and registered as a highest instability district during 2000-01 to 2006-07

The table 4.2.13, shows the percentage area under different crops in 1980-83, 1990-93 and 2004-07 and growth in percentage area. We find that the area under rice rose from 8.9 percent to 11.6 percent from 1980-83 to 1990-93 and later it increased 15.9 percent in 2004-07. It shows that the share of area under rice became approximately double from 1980-83 to 2004-07, while the area under wheat increased from 28.6 percent to 32.4 percent from 1980-83 to 1990-93 and later it rose 35.7 percent in 2004-07.

On the other hand area declined in case of coarse cereals and pluses. The share of area under bajra decreased from 15.11 percent to 10.4 percent from 1980-83 to 1990-93 and later it became 9 percent in 2004-07. The share of area under Sugarcane shows a marginal declining trend while the share of area under cotton registered a marginal growth from 6.6 to 8.9 percent from 1980-83 to 2004-07. It showed that both rice and wheat gained 6 percent more area while nine crops lost 15.5 percent area from 1980-

83 to 1990-93. In 2004-07 the share of area under both crops is 51 percent while the share of nine crops comes down by 13 percent in 2004-07. *(See table no 1.1)*

The highest area shifted from gram to other crops by 12 percent from 1980-83 to 2004-07. The highest area shifted towards rice by 8 percent followed by wheat by 7 percent and those crops which area not under this study that area calculated by other crops (all vegetable) by 8 percent from 1980-83 to 2004-07. *(See table no 4.2.13)*

Table No:-4.2.13 Percentage Area shift from one crop to another crop

Rabi Crops				Kharif Crops			
CROPS	**1980-83**	**1990-93**	**2004-07**	**CROPS**	**1980-83**	**1990-93**	**2004-07**
Wheat	28.6	32.4	35.7	Rice	8.9	11.6	15.9
Gram	13.7	7.7	1.8	Cotton	6.6	8.8	8.9
RP SEEDS*	3.3	0.3	0.1	Bajra	15.1	10.4	9.1
Barley	2.0	0.9	0.4	Maize	1.2	0.5	0.2
				Jowar	2.2	2.0	1.4
				Sugar cane	2.4	2.6	2.0
Other	15.5	22.1	23.8	Other	15.5	22.1	23.8

RP SEEDS* = Rape seed and mustard

There are two seasonal crops one rabi another kharif, wheat, gram, rape seed and mustard are rabi crops, while rice cotton, jowar, bajra, maizeand sugarcane are kharif crops. In rabi crops, the area declined in all crops except wheat. Wheat gained 4 percent more area from 1980-83 to 1990-93 and 3 percent from 1990-93 to 2004-07. While the area under gram declined by 12 percent from 1980-83 to 2004-07. In Kharif crops area under rice and cotton is increasing while area under bajra and maize is declined, sugarcane showed a marginal growth during eighties while it showed a marginal declined from 1990-93 to 2006-07. . *(See table no 4.2.13)*

District wise, it is found that during 1980-81 the five districts, Jind, Hisar, Rohtak, Ambala, and Sirsa were more diversified districts while Karnal, Kurukshetra and Bhiwani were comparatively low diversified districts. Further, the relatively more developed district, like Karnal, Kurukshetra, Sonepat, and Faridabad registered low level of diversification from 1980-81 to 2006-07. It may be due to adaptation of rice-wheat cropping pattern system in these districts. The level of crop diversification is declining in almost all the districts. It shows that these districts are getting more specialised in a few crops like rice wheat, and cotton. The growth in area shows the same trend that the area under rice, wheat and cotton is increasing while the area under coarse cereals and pulses is declining since 1980-81.

The study shows among rabi crops, wheat, gram, rapeseed and mustard, the area under gram declined since 1980-81 while the area under wheat increased in all the time periods. It shows that the area is diversifying from gram to wheat since 1980-81. In kharif crops, area under rice and cotton increased while area under bajra, jowar, maize, sesamum, and groundnut declined in all the time periods. It shows that the area shifted from bajra, maize, sesamum, groundnut to rice and cotton.

The trends in crop diversification clearly shows that the relative share of area under rice, wheat has increased considerably, while in case of cotton the increase is marginal. The area is diversifying from gram to wheat since 1980-81. In kharif crops, area under rice and cotton increased, while area under bajra, jowar, maize, sesamum, and groundnut declined in all the time periods. It is evident that the area has shifted from bajra, maize, sesamum, groundnut to rice and cotton.

District wise, it is find that in 1980-81 the five districts, Jind, Hisar, Rohtak, Ambala, and Sirsa were more diversified districts while Karnal, Kurukshetra and Bhiwani were comparatively low diversified districts. Further, the relatively more developed district, like Karnal, Kurukshetra, Sonepat, and Faridabad registered low level of diversification from 1980-81 to 2006-07. It may be due to adopting rice-wheat cropping pattern system in

these districts. The level of crop diversification is declining in almost the districts which show that the districts are getting more specialization in a few crops like rice wheat, and cotton. The growth in area shows the same trend that the area under rice, wheat and cotton is increasing while the area under coarse cereals and pulses is declining since 1980-81.

Chapter-5

Acceleration and Deceleration in Growth

Previous study shows that during the 1980s all crops was grown in Haryana; the gross cropped area was divided in almost crops. Even the area under coarse cereals was declining however it was sharply decnined in groundnut, massar and sesamum. During 1990s, the area shifted towards particularly two or three crops such as rice, wheat and cotton. The major changes took place in area production and yield in rice and wheat. So that in this chapterthe, the stidy analyse the accerletation and decerelation in growth rate of area, production and yield only for rice and wheat.

To analyse the acceleration and deceleration in growth rate, the following quadratic function is used

$$\text{Log } y = a + bt + ct^2$$

Where y is area, production and yield of *ith* crop, b and c are the coefficient of t and t^2 which shows acceleration and deceleration in growth rate.

Growth rate may be negative, positive or constant. Acceleration and deceleration shows the trend of growth rate. When growth rate is positive, its trends may be increasing or decreasing. It is the same in cases of negative growth rate. It means when t is positive t^2 may be negative or positive and when t is negative c may be positive or negative.

To study this easily we have divided the results into four categories.

1. The first category shows positive growth rate at an increasing rate. In this category coefficient of b and c both will be positive at increasing rates. Y increases monotonically.
2. The second category shows positive growth rate at decreasing rates. In this category b will b positive while coefficient of c will be negative.

3. In the third category, b is negative and c is positive, which shows that growth rate is negative at decreasing rate rates.
4. The fourth category shows negative growth rate at increasing rates. In this category both b and c are negative. y decreases monotonically.

Acceleration and deceleration of growth under rice during 1980-81 to 1989-90

Area				
Category	Distt. Name	B	C	R2
First	Ambala	0.0109*	0.0017*	0.15
	Sonipat	0.0493	0.0118	0.57
Second	Hisar	0.0209*	-0.006*	0.78
	Sirsa	0.0066*	-0.003*	0.49
	Gurgaon	0.0505*	0.002**	0.55
	Faridabad	0.0559*	-0.011*	0.64
	Jind	0.0118*	0.002**	0.29
	Rohtak	0.0049*	-0.002*	0.14
Third				
Fourth	Mahendergarh	-	-	-
	Bhiwani	-0.028*	-0.031*	0.74
	Karnal	-0.004*	-0.006*	0.72
	Kurukshetra	-0.014*	-0.008*	0.50
Production				
First	Gurgaon	0.0089**	0.0002**	0.12
	Jind	0.0098**	0.0014**	0.072
Second	Hisar	0.0166*	-0.008*	0.73
	Faridabad	0.0113*	-0.036*	0.67
	Ambala	0.0033*	0.004*	0.10
	Karnal	0.0014**	-0.002*	0.34
	Rohtak	0.0327*	0.003**	0.22
	Sonipat	0.041**	-0.009*	0.68
Third	Kurukshetra	-0.001**	0.001*	0.029
Fourth	Sirsa	- 0.017*	- 0.006*	0.56
	Mahendergarh	-	-	-

* Significant at 5 percent ** Significant at 10 percent

Acceleration and deceleration of growth under rice during 1980-81 to 1989-90

	Yield			
Category	Distt. Name	B	C	R2
First	Hisar	0.008*	0.001*	0.18
	Gurgaon	0.0014**	0.0003*	0.30
	Ambala	0.0332*	0.0061**	0.62
	Kurukshetra	0.0138	0.0092	0.52
	Rohtak	0.0262*	0.0023*	0.30
	Faridabad	0.003**	0.004*	0.06
	Karnal	0.004*	0.0001*	0.15
Second	Sonipat	0.0384*	-.001**	0.61
Third	Sirsa	-0.012*	-0.0016**	0.25
	Jind	-0.001**	-0.0018**	0.11
Fourth				

* Significant at 5 percent ** Significant at 10 percent

There are only two districts, Ambala and Sonipat, in the first category, which show positive growth rate at increasing rate under area. There are six districts - Hisar, Sirsa, Gurgaon, Faridabad, Jind and Rohtak, which registered positive growth rate at decreasing rate. Not one district comes under the third category. The results show that there are three districts - Bhiwani Karnal and Kurukshetra, which registered under the fourth category. They show negative growth rate at increasing rate under area.

In the case of production, Gurgaon and Jind fall into the first category, while Hisar, Faridabad, Ambala, Karnal, Rohtak, and Sonipat are registered in the second category, which showed positive growth rate at decreasing rate. Kurukshetra is the only district which registered negative growth rate at decreasing rate; while Sirsa and Jind is registered under the fourth category.

In the case of yield, there are six districts Hisar, Gurgaon, Ambala, Kurukshetra and Rohtak which recorded in first category. Sonipat is the only district under the second category. While Jind and Sirsa are under the third category, which shows negative growth rate at an decreasing rate rate. There is no district under the fourth category.

Acceleration and deceleration of growth under rice during 1990-91 to 1999-2000

	Area			
Category	Distt. Name	B	C	R2
First	Ambala	0.014436**	0.000611**	0.93
	Karnal	0.014275**	0.000439**	0.84
	Rohtak	0.130121*	0.005967*	0.74
	Mahendergarh	0.05112*	0.009983*	0.95
	Bhiwani	0.193764	0.030958	0.86
	Kurukshetra	0.053087*	0.002522*	0.93
	Sirsa	0.019464	0.003472	0.83
Second	Sonipat	0.058981	-0.00589	0.97
	Faridabad	0.070106*	-0.00164**	0.94
	Gurgaon	0.1025*	-0.00686*	0.89
	Jind	0.046284*	-0.00069*	0.94
Third				
Fourth				
1990-91 to 1999-2000 (Production)				
First	Ambala	0.011183*	0.000903**	0.73
	Kurukshetra	0.003175*	0.00854*	0.26
	Karnal	0.00781*	0.00615*	0.38
	Rohtak	0.111896*	0.003432**	0.71
	Jind	0.038978*	0.002877**	0.89
	Hisar	0.039977	0.002997	0.91
Second	Sonipat	0.042577*	-0.00245*	0.91
	Faridabad	0.060902*	0.00036**	0.94
	Sirsa	0.014175*	0.00043**	0.65
	Gurgaon	0.087*	-0.002**	
Third				
Fourth				

* = Five percent of Significance ** = Ten Percent of Significance

Acceleration and deceleration of growth under rice during 1990-91 to 1999-2000

	(Yield)			
Category	Distt. Name	B	C	R2
First	Ambala	0.020294*	0.000197**	0.75
	Rohtak	0.026679*	0.003049*	0.82
	Hisar	0.026749*	0.006452*	0.66
	Sirsa	0.014959*	0.020577*	0.27
Second	Kurukshetra	0.00984*	-0.0079*	0.32
	Karnal	0.00603*	-0.0089*	0.33
	Sonipat	0.01467*	-0.0024*	0.57
	Gurgaon	0.00426*	-0.0015*	0.16
	Jind	0.00751*	-0.0037*	0.37
Third	Faridabad	-0.0071*	0.00266*	0.31
Fourth				

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

The result shows that there are six districts in the first category which show positive growth rate at increasing rate under area of rice during the second time period; these are Ambala, Karnal, Rohtak, Mahendergarh Bhiwana, Kurukshetra and Sirsa. While there are four districts which show positive growth rate at decreasing rate. There is no district in the third and fourth categories under area of rice during 1990-91 to 1999-2000. This is the same in the case of production, with the exception of Jind has registered under the second category in the case of area, while it is under first category in the case of production. Sirsa fell into the first category in area while it is in the second category in the case of production of rice during 1990-91 to 1999-2000. There are no districts under the third and fourth categories.

The results show that all the district shows positive growth except Faridabad. Ambala, Rohtak, Hisar and Sirsa. Under these districts the yield registered an increasing rate of

growth at increasing rate. Faridabad is only district which shows negative growt at decreasing rate.

Acceleration and deceleration of growth under rice during 2000-01 to 2006-07

	(Area)			
Category	Distt. Name	B	C	R2
First	Ambala	0.006301*	0.003913*	0.49
	Karnal	0.002319*	0.001373*	0.39
	Bhiwani	0.042308*	0.007265*	0.77
	Hisar	0.010674*	0.004473*	0.61
Second	Sonipat	0.012916*	0.00306*	0.68
	Sirsa	0.0028*	0.0162*	0.46
	Faridabad	0.0003*	0.0097	0.21
Third				
	Rohtak	-0.00295**	0.031691**	0.55
	Gurgaon	-0.04856**	0.040701**	0.15
	Mahendergarh	-0.02007*	0.032172*	0.72
	Jind	-0.00668**	0.013703*	0.58
Fourth	Kurukshetra	-0.00238*	-0.00129*	0.68
2000-01 to 2006-07(Production)				
First	Ambala	0.013369**	0.004889*	0.65
	Panipat	0.011487*	0.000698**	0.50
	Sonipat	0.007357**	0.016909**	0.65
	Rohtak	0.005027**	0.031858*	0.79
	Jind	0.010669*	0.019801*	0.62
	Hisar	0.032534*	0.001489**	0.71
Second	Kurukshetra	0.012925*	-0.00146*	0.98
	Gurgaon	0.088571**	-0.01735**	0.10
	Sirsa	0.028819*	-0.00548*	0.95
Third	Faridabad	-0.00881*	0.013643*	0.39
	Bhiwani	-0.00693*	0.016075*	0.43
Fourth	Mahendergarh	-0.00446*	-0.00765*	0.36

* = Five percent of Significance ** = Ten Percent of Significance

Acceleration and deceleration of growth under rice during 2000-01 to 2006

	2000-01 to 2006(Yield)			
Category	Distt. Name	B	C	R2
First	Ambala	0.0055*	0.0017*	0.76
	Sonipat	0.0106*	0.0006**	0.28
	Rohtak	0.0280*	0.0098*	0.74
	Jind	0.0167*	0.0047*	0.84
Second	Kurukshetra	0.0137*	0.0028**	0.96
	Karnal	0.0118*	-0.0014	0.47
	Gurgaon	0.0129	0.0002*	0.97
	Mahendergarh	0.0125	0.0009*	0.99
	Hisar	0.0144	-0.0093	0.38
	Sirsa	0.0154*	0.0019*	0.88
Third	Faridabad	-0.0071**	0.0035	0.77
	Bhiwani	-0.0418*	0.0176**	0.60
Fourth				

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

The results show that there are four districts under first category which show positive growth rate at increasing rate. These are Ambala, Karnal, Bhiwani, and Hisar. Sonipat, Sirsa and Faridabad show positive growth rate at increasing rate under area of rice during 2000-01 to 2006-07. There are four districts under the third category which show negative growth rates at increasing rates under area during 2000-01 to 2006-07; these are Gurgaon, Mahendergarh and Jind. Kurukshetra registered negative growth at decreasing rate.

In the case of growth of production, there are five districts which show positive growth rates at an increasing rate; these are Ambala, Panipat, Sonipat, Jind and Hisar. Kurukshetra, Gurgaon and Sirsa show positive growth rates at a decreasing rate in growth of production of rice during the time period. Bhiwani and Faridabad shows negative growth at decreasing rate. Faridabad and Bhiwini Show negative growth at decreasing rate. Mahendergarh shows negative growth at increasing rate during 2000-01 to 2006-07.

In terms of yield, Ambala, Sonipat, Rohtak, Jind, Faridabad, and Bhiwani show positive growth at increasing rate while Kurukshetra, Karnal, Gurgaon, Mahendergarh, Hisar and Sirsa show positive growth at decreasing rates from 2000-01 to 2006-07.

Acceleration and deceleration of growth under wheat during 1980-81 to 1989-90

Wheat	1980-81 to 1989-90 (Area)			
Category	Distt. Name	B	C	R2
First	Gurgaon	0.0083**	0.0086*	0.13
	Mahendergarh	0.0122**	0.0109**	0.14
	Ambala	0.0126**	0.0134**	0.11
	Karnal	0.0126**	0.0134**	0.11
Second	Hisar	0.0180*	-0.0019*	0.82
	Sirsa	0.0582*	-0.0098*	0.32
	Bhiwani	0.0156*	-0.0015**	0.52
	Faridabad	0.0122*	-0.0041**	0.90
	Rohtak	0.0070**	-0.0068**	0.09
Third	Jind	-0.0007*	0.0018*	0.08
Fourth	Kurukshetra	-0.0045**	-0.0043*	0.71
	Sonipat	-0.0090**	-0.0050*	0.60
1980-81 to 1989-90 (Production)				
First	Bhiwani	0.0322*	0.0012**	0.84
	Faridabad	0.4949*	0.4949**	0.49
	Mahendergarh	0.0209*	0.0051**	0.69
	Ambala	0.0162*	0.0009**	0.48
	Karnal	0.0293*	0.0123*	0.16
	Rohtak	0.0245*	0.0007**	0.76
Second	Hisar	0.0377*	-0.0008**	0.86
	Sirsa	0.031*	-0.0025*	0.80
	Gurgaon	0.0111*	-0.0030*	0.47
	Jind	0.0293*	-0.0017*	0.80
	Kurukshetra	0.0251*	-0.0020*	0.89
	Sonipat	0.0069*	-0.0033*	0.35
Third				
Fourth				

* = Five percent of Significance ** = Ten Percent of Significance

Acceleration and deceleration of growth under wheat during 1980-81 to 1989-90

Wheat	1980-81 to 1989-90 (Yield)			
Category	Distt. Name	B	C	R2
First	Hisar	0.0201*	0.0019*	0.69
	Bhiwani	0.0177*	0.0031*	0.74
	Gurgaon	0.0201*	0.0019*	0.69
	Faridabad	0.0144*	0.0025*	0.57
	Jind	0.0188*	0.0031*	0.75
	Mahendergarh	0.0213*	0.0030*	0.79
	Ambala	0.0118**	0.0023*	0.47
	Rohtak	0.0158*	0.0001*	0.80
	Sonipat	0.0172**	0.0021**	0.72
Second	Sirsa	0.0081	-0.0026	0.34
	Karnal	0.0092*	-0.0038*	0.86
	Kurukshetra	0.0110**	-0.0055*	0.59
Third				
fourth				

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

The result shows that there are four districts under first category which show positive growth rate at increasing rate under area during 1980-81 to 1989-90. This are Gurgaon, Mahendergarh, Ambala, and Karnal. There are five districts which show positive growth rate at decreasing rate: Hisar, Sirsa, Bhiwani, Faridabad and Rohtak. Jind show positive growth rate at increasing rate. Kurukshetra and sonipat recored negative growth rate at decreasing rate under area during the same time period.

In the case of production there are six districts viz. Bhiwani, Faridabad, Mahendergarh, Ambala, Karnal and Rohtak which shows positive growth rate at increading rate. While Hisar, Sirsa, Gurgaon, Jind, Kurukshetra, and Sonipat show

positive growth rates at a decreasing rate of production. There is no district under the third or fourth category.All districts show positive growth rates at increasing rate in yield except for Sirsa, Karnal and Kurukshetra, this three districts show positive growth rate at decreasing rate. There are no districts under third and fourth category.

Acceleration of growth under wheat during 1990-91 to 1999-2000

Wheat	(Area)			
Category	Distt. Name	B	C	R2
First	Ambala	0.010456	0.001692	0.60
	Karnal	0.000889*	0.007375*	0.39
	Rohtak	0.007*	0.005*	0.62
	Mahendergarh	0.034407*	0.005512	0.71
	Bhiwani	0.030732	0.000244**	0.96
	Gurgaon	0.0019	0.0001	0.76
Second	Sonipat	0.011337*	-0.00455*	0.57
	Faridabad	0.007143*	-0.00045*	0.67
	Jind	0.007*	-0.001*	0.84
	Hisar	0.012592	-0.001*	0.97
	Sirsa	0.01582	-0.00117*	0.92
Third	Kurukshetra	-0.00812**	0.01093*	0.37
Fourth				
1990-91 to 1999-2000 (Production)				
First	Ambala	0.010456*	0.001692*	0.60
	Karnal	0.000889**	0.007375*	0.49
	Rohtak	0.013595*	0.003246*	0.65
	Mahendergarh	0.034407*	0.005512*	0.71
	Bhiwani	0.030732	0.000244**	0.96
Second	Sonipat	0.012528*	-0.00623*	0.58
	Faridabad	0.014342*	-0.00268*	0.96
	Gurgaon	0.031359*	-0.00133*	0.92
	Jind	0.012934*	-0.00164*	0.78
	Hisar	0.014775	-0.00137*	0.95
	Sirsa	0.007517*	-0.00387	0.74
Third	Kurukshetra	-0.00646*	0.012346*	0.41
Fourth				

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08) * = Five percent of Significance, ** = 10% of Significance

Acceleration and deceleration of growth under wheat during 1990-91 to 1999-2000

Wheat	1990-91 to 1999-2000 (Yield)			
Category	Distt. Name	B	C	R2
First	Ambala	0.032343*	0.000309*	0.86
	Rohtak	0.048483*	0.004517*	0.89
	Hisar	0.043785*	0.005624**	0.87
	Sirsa	0.003327**	0.000246**	0.36
	Kurukshetra	0.00139**	0.009235*	0.43
Second	Faridabad	0.00725*	-0.00121*	0.64
	Gurgaon	0.011494*	-0.0027**	0.74
	Mahendergarh	0.001668*	-0.0013*	0.65
	Bhiwani	0.005837*	-0.0004**	0.69
	Jind	0.006169*	-0.00049*	0.66
	Karnal	-0.0034*	0.009751**	0.44
Third				
fourth	Sonipat	-0.01066*	-0.00302**	0.10

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

During 1990-91 to 1999-2000, there are six districts which show positive growth rates at increasing rate under area of wheat: Ambala, Karnal, Rohtak, Mahendergarh, Bhiwani, and Gurgaon. Five districts show positive growth rate at decreasing rate, these are Sonipat, Faridabad, Jind, Hisar, and Sirsa. Kurukshetra is only district which is under third category. There is no district under fourth category in case of area.

In the case of production, Ambala, Karnal, Rohtak, Mahendergarh and Bhiwani show positive growth rate at increasing rate while Sonipat, Faridabad, Gurgaon, Jind, Hisar and Sirsa registered positive growth rate increasing rate. Kurukshetra shows negative growth rate at increasing rate during 1990-91 to 1999-2000. Threre is no district under fourth category.

In the case of yields, Ambala Rohtak, Hisar, Sirsa and Kurukshetra show positive growth rate at increasing rate during 1990-91 to 1999-2000. Five districts show positive growth rate at a decreasing rate, these are Faridabad, Gurgaon, Mahendergarh, Bhiwani, Jind and Karnal. Sonipat shows a negative growth rate at a increasing rate.

Acceleration and deceleration of growth under wheat during 2000-01 to 2006-07

Wheat	(Area)			
Category	Distt. Name	B	C	R2
First	Karnal	0.0025*	0.0001**	0.69
	Sonipat	0.0001**	0.0033*	0.87
	Hisar	0.0017*	0.0011*	0.57
	Sirsa	0.0026*	0.0019*	0.27
Second	Ambala	0.0070*	-0.0006*	0.91
	Kurukshetra	0.0047*	-0.0022*	0.92
Third	Rohtak	-0.0109	0.0027*	0.95
	Gurgaon	-0.0008**	0.0087*	0.87
	Mahendergarh	-0.0163*	0.0012*	0.92
	Bhiwani	-0.0083	0.0014**	0.52
	Jind	-0.0002**	0.0001**	0.03
fourth	Faridabad	-0.010*	-0.0057*	0.57
2000-01 to 2006-07 (Production)				
Category	Distt. Name	B	C	R2
First	Ambala	0.0019*	0.0002*	0.36
Second				
Third				
	Kurukshetra	-0.0014**	0.0003	0.10
	Karnal	-0.0026*	0.0028*	0.95
	Sonipat	-0.0020*	0.0015*	0.25
	Rohtak	-0.0173*	0.0010**	0.93
	Gurgaon	-0.0054*	0.0051*	0.74
	Mahendergarh	-0.0132*	0.0024*	0.91
	Bhiwani	-0.0088**	0.0012	0.56
	Hisar	-0.0040*	0.0008**	0.39
Fourth	Faridabad	-0.0155**	-0.0076**	0.70
	Jind	-0.0044*	-0.0001**	0.74
	Sirsa	-0.0079*	-0.0005**	0.50

* = Five percent of Significance ** = Ten Percent of Significance

Acceleration and deceleration of growth under wheat during 2000-01 to 2006-07

Wheat	2000-01 to 2006-07 (Yield)			
Category	Distt. Name	B	C	R2
First	Mahendergarh	0.0042*	0.0008**	0.33
Second				
Third	Ambala	-0.0019*	0.0035*	0.26
	Kurukshetra	-0.0047	0.0050*	0.75
	Karnal	-0.0062	0.0027*	0.90
				0.33
fourth	Sonipat	-0.0038	-0.0019*	0.36
	Rohtak	-0.0048	-0.0027*	0.47
	Faridabad	-0.0061	-0.0020**	0.84
	Gurgaon	-0.0007*	-0.0014*	0.34
	Bhiwani	-0.0007	-0.0001**	0.46
	Jind	-0.0042	-0.0001**	0.85
	Hisar	-0.0065	-0.0017*	0.57
	Sirsa	-0.0112	-0.0025*	0.85

Data Sources: Statistical Abstract of Haryana, (1980-81 to 2007-08)

The results show that there are four districts which show positive growth rate at increase rate under area of wheat, these are Karnal, Sonipat, Hisar and Sirsa. While Ambala and Kurukshetra show positive growth rate at increasing rate at decreasing rate. Five districts viz Rohtak, Gurgaon, Mahendergarh, Bhiwani, and Jind show negative growth rate at decreasing rate. Faridabad is the only district which shows negative growth rate at decreasing rate under area of wheat during 2000-01 to 2006-07.

In case of production the performance is not satisfactory, Ambala is the only district which shows positive growth rate at increasing rate except this district. Kurukshetra Karnal, Sonipat, Rohtak, Gurgaon, Mahendergarh, Bhiwani and Hisar register negative growth rate at an increasing rate, while Faridabad, Jind and Sirsa show negative growth rate at decreasing rate during 2000-01 to 2006-07. The performance of

yields was the worst during 2000-01 to 2006-07, while Mahendergarh is the only district that showed positive growth rate at increasing rate. Except this district, all districts show negative growth rates.

In brief, the period of 1980`s has been good from the point of view of acceleration in growth of area, production and yield for rice and wheat in most of the disricts in Haryana. During 1990`s, there are acceleration in the area and production of rice in majority of the districts. In the same period the yield of the rice is showing sign of deceleration in the growth in majority of the districts. In case of wheat, the area, production and yield keep acceletating during 1990`s. The acceleration in the yield is accelerating the production of rice despite the fact that there is deceleration in the area under rice in some districs during 2000-01 to2006-07. The situation in wheat turned around during 2000-01 to 2006-07, as there is deceleration in the yield and production in majority of the district is accompanied with the deceleration in the area under wheat cultivation in half of the districts.

Chapter-6

Summary and Conclusion

Haryana agriculture sector has improved sharply after the adoption of new technology during mid sixties. It has enhanced area, production and productivity of almost crops. Due to adoption of new technology, India became self-sufficient in foodgrains production. In this achievement of self-suffiency in foodgrains production in India; Haryana played a major role. The total foodgrains production in the state increased in the last four decade. However there is a decline in coarse cereals and pulses, due to shift of area towards high yielding crops like rice and wheat. Present study will attempt to study of crop diversification and agriculture growth in Haryana since 1980-81.

The objectives of the study are:

To analyse the growth pattern of Production, Area and Yield of major crops for all the districts of Haryana.

To examine the instability in crop production in each district of Haryana

To estimate crop diversification in each district in Haryana; pre and post Reforms period.

To analyse the pattern of acceleration and deceleration in rate of growth of majors crops in Haryana

The study is based on the secondary data of major crops production, area and yield for the years 1980-81 to 2006-07. The Data sources are given below:

- Statistical Abstracts of Haryana (1980-81 to 2006-07).
- Economic Survey of Haryana (Various issues).
- Statistical Abstract of India (Various issues).

To achieve the above mention objective are four objectives in this study. It is use different method to achieve different objective

To calculate the annual compound growth rate, a semi log equation below has been used

$$\text{Log } Yt = a + bt$$

Where Yt, is Area, production, and Yield of different Crop as (Rice, Jawar, Bajar, Maize, Wheat, Gram, Moong, Massar, Rape Seed and Mustard Groundnut, Sesamum, American, Desi and sugarcane), coefficient **b** shows the growth pattern.

To calculate instability of crop production, Cuddy-Della Valle index has been used in the present.

Cuddy-Della valle index $= C.V.*(1-R^2)^{0.5}$

Where C.V. = Coefficient of Variation

R^2 = ESS/TSS i.e. ratio of explained variation to total variation.

ESS = Variation explained by explanatory variable.

TSS = Total Variation.

The crop diversification in Haryana and application of Herfindahl index

There are many methods to measure crop diversification. Among them some important methods are, Herfindahl index, Index of maximum proportion, Entropy Index and Simpson Index, etc. Here Herfindahl Index is used to measure the diversification.

Herfindahl index is defined as:

$$HI = \sum si^2$$

si = the share of area of i^{th} crop of Gross Cropped Area, $si = Yi / Y$

Where Yi is the area of i^{th} crop and Y is Gross Cropped Area

The value of HI lies between 0 to 1. It indicates that the lower value of HI shows more diversification, while the higher value show relatively more specialization of a few crops.

Acceleration and Deceleration in growth rate

To study the acceleration and deceleration in growth rate of area, production and yields, one uses the semi-log quadratic equation of the following form has been used

$$\text{Log } Y = a + bt + ct^2$$

Where, Y is area, Production and Yield of the crop

a = intercept, b and c are the coefficient of t and t^2 respectively which shows acceleration or deceleration in growth rate.

Performance of Agriculture sector since 1980-81:

There is an considerable growth in the input use and agriculture infrastructure in Haryana during 1990`s as compare to 1980`s. The consumption of fertilizer has increased, it was 135 percent total increased in consumption of fertilizer from 1980-81

to 1990-91; while its total growth was 71 percent from 1990-91 to 2006-07. The number of tractor per 100 hectare has increased from 0.96 tractors in 1980-81 to 2.20 tractors in 1990-91, and in 2006-07 it increases to 3.90 tractors. Haryana has a relatively better irrigation infrastructure. The area under irrigation has increased from 60.5 percent in 1980-81 to 83.7 percent in 2006-07.

Growth in Area Production and Yield

In Haryana, the growth rate of agricultural production shows changes in spatial pattern of different crops. On the one hand some crops like rice and wheat show a very satisfactory performance in their production in all the three period (1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-01 to 2006-07). On the other hand crops like Gram, Massar, Maize, Sesamum, groundnut, show unsatisfactory performance in their production. All these crops registered negative growth rate in production over the periods. In the case of total pluses, the production has shown a declining trend over the periods. Gram showed highest declining trend in both, production and area. Moong registered negative growth rate during 1980's and 1990's while it showed positive growth rate during 2006-07. The production of cotton registered positive growth rate over the periods. American cotton registered higher significant growth in production and area than Desi cotton at the state level and districts wise. Oilseeds showed a marginal increase since 1980-81.

Districts wise, area under rice increased in the entire districts except Kurukshetra, Karnal and Bhiwani during 1980's. While during 1990's it increased in all the districts. Even during 1990's the area under rice showed relatively more significantly growth rate in rainfed districts like, Bhiwani, Gurgaon, Hisar, Sonepat and Rohtak etc. There are two main reason behind it; one crop diversification another expansion of irrigation facilities. Production and yield increased in almost the districts. While during 2000-01 to 2006-07, Area under rice declined in many districts like, Kurukshetra, Sonepat, Gurgaon, Mahendragarh, and Jind. The area under rice in these districts shows a shift

towards cotton. The reason was increasing cost of irrigation by tube-wells due to increase the prices of diesel continuously from last a few years.

Area, production and yield of wheat increased in almost all the districts of state during 1980's and during 1990's. Even area under wheat declined in some Kurukshetra yet the production also increased due to increased in yields. One major change is noticed here is that the production and yield of wheat declined in almost all the districts during 2000-01 to 2006-07. One of the reasons is increasing cost of fertilizer, other inputs and declining subsidies and investment in agriculture by the government. Total cotton shows a positive growth rate over the periods. Even American cotton showed relatively higher growth in area production and yield than Desi cotton.

Study show that, rice wheat, cotton, registered relatively more significantly growth rate in area, production and yield over the period. Wheat registered increasing trends in area, production and yield in almost all the districts of the state of Haryana. Rice shows relatively more growth in area and production in those districts which have good irrigation facilities like Karnal and Ambala. On the other hand cotton shows relatively more growth in area and production in rainfed districts like Sirsa, Hisar, Rohtak, Mahendragarh etc. Other crops like ground nut, sesamum, maize, barley and massar, show declining trend in area and production after 1980's due to crop diversification.

Acceleration and Deceleration in Growth Rate

The period of 1980`s has been good from the point of view of acceleration in growth of area, production and yield for rice and wheat in most of the districts in Haryana. During 1990`s, there are acceleration in the area and production of rice in majority of the districts. In the same period the yield of rice is showing sign of deceleration in the growth in majority of the districts. In case of wheat, the area, production and yield kept accelerating during 1990`s. The acceleration in the yield is accelerating the production of rice despite the fact that there is deceleration in the area

under rice in some districts, like Rohtak and Jind during 2000-01 to 2006-07. The situation in wheat turned around during 2000-01 to 2006-07, as there is deceleration in the yield and production in majority of the districts and is accompanied with the deceleration in the area under wheat cultivation in half of the districts.

Acceleration and deceleration in growth rate of Rice

Ambala and Sonipat, which showed positive growth at increasing rate in area under rice during eighties but during ninties four more districts, Karnal Rohtak, Sirsa, amd Mahendergarh showed positive growth at increasing rate. While there are six districts - Hisar, Sirsa, Gurgaon, Faridabad, Jind and Rohtak which registered positive growth rate at decreasing rate during 1980-81 to 1989-90.

There are six districts which show positive growth rate at increasing rates under area of rice during ninties; these are Ambala, Karnal, Rohtak, Mahendergarh Bhiwana , Kurukshetra and Sirsa. While there are four districts which show positive growth rate at decreasing rate. There is no district which registered negative gowth reate under area of rice during 1990-91 to 1999-2000. Kurukshetra registered positive growth rate in first two time periods however it showed negative growth rate during 2000-01 to 2006-07. One notices here that Hisar, Sirsa and Bhiwani are rainfed district of Haryana but these showed positive growth rate at increasing rate in area under rice since 1990-91, due to expansion of irrigation facilities.

In case of production, all district registered positive growth rate except Sirsa Mahendergarh and Kurukshetra during eighties. Only two districts Gurgaon and Jind shows positive growth rate at increasing rate, even Gurgaon is rainfed district of Haryana after that it registered positive growth rate at increasing rate in production of rice during eighties. During 2000-01 to 2006-07 all districts registered positive growth rate in production at increasing rate except Kurukshetra, Mahendergarh and Sirsa registered positive growth rate at decreasing rate.

In the case of yield, there are six districts - Hisar, Gurgaon , Jind ,Ambala, Kurukshetra and Rohtak which recorded positive growth at increasing rate while Sirsa, Faridabad and Karnal showed negative growth rate increasing rate durind eighties. Ambala, Sonipat, Rohtak, Jind, Faridabad, and Bhiwani show positive growth at increasing rate while Kurukshetra, Karnal, Gurgaon, Mahendergarh, Hisar and Sirsa show positive growth at decreasing rate during 2000-01 to 2006-07.

Acceleration and Deceleration in Growth Rate of Wheat

Area under wheat registered positive growth rate in all the districts except Jind, Kurukshetra and Sonipat during eighties. Among these district Sonipat and Kurukshetra showed negative growth rate at increasing rate while Sonipat registered negative growth rete at decreasing rate during eighties. Due to crops diversification the area is diversifying towards wheat and it showed positive growth rate in all the district except Kurukshetra during nineties. During 2000-01 to 2006-07 the area under wheat declined and some districts like, Rohtak Mahendergarh, Bhiwani, Jind and Faridabad registered negative growth rate at decreasing rate. As we know that Bhiwani, and Mahendergarh are rain fed district of Haryana so that the area of these district shifted towards rape seeds and mustard, because this crop needs low irrigation facilities.

The study shows that the production of wheat has a impressive growth in all the districts since 1980-81. During eighties and nineties all districts registered positive growth rate in production except Kurukshetra. During eighties all district showed positive growth rate at increasing rate except sonipat, it showed positive growth rate at decreasing rate while during nineties Kurukshetra was the only district which showed negative growth rate at decreasing rate. Even the performance is not desirable during 2000-01 to 2006-07 all district registered negative growth in production, there is only one district, Ambala which shows positive rate at increasing rate while . There may be

many reason behind, one of them may be decline subsidy on agricultural inputs and increasing prices of these inputs due to liberalization policy which India adopted.

Yield shows a special performance of agriculture sector since 1980-81, in different periods. During eighties yields registered positive growth rate at increasing rate in almost all the districts. The main reason was expansion of irrigation facilities and increase in per hectare consumption of fertilizer.

During nineties the productivity increased at increasing rate in Ambala Rohtak, Hisar, Sirsa and Kurukshetra while it increased at decreasing rate in four more districts Faridabad, Gurgaon, Mahendergarh, Bhiwani and Jind. It show that during niteties the productivity showed positive trends in all district except Karnal. But during 2000-01 to 2006-07 it shows negative growth in all the districts.

Production instability among crops

The instability has been low and also declined over the time in wheat and rice and there are clear evidence of crop diversification towards rice, wheat, cotton and other crops. The instability in wheat, rice and sugarcane has been low, while in gram moong massar it has been high in all the periods. The result shows that the trend of instability is still high in many crops like gram, moong massar. Instability in Jowar has declined sharply from 1980-81 to 2006-07. During eighties Jowar`s production declined due to crop diversification, however being an animal feed it could not be ignored. That was why the production of jowar increased later and with this effect the instability declined and it became low instability crops during 2000-01 to 2006-07.On the other hand the instability is still high in pluses and coarse cereals because area under these crops is shifted towards rice and wheat and increased the instability in the production of these crops.

District wise, it is found that the instability is low in wheat in all the districts over time period. The instability in Rice is also low, however only in those districts which are relatively advance in agriculture e.g. Karnal, Kurukshetra. The instability in production of rice is declining in karnal, Kurukshetra, Ambala, Jind, Hisar, Sirsa and Faridabad throughout the study period. Gurgoan which recorded medium instability during first period has recorded highest instability during third period. It may be because larger part of Gurgaon comes under rainfed area; therefore instability of rice is increasing over the period and registered as a highest instability district during 2000-01 to 2006-07.

Crop Diversification in Haryana:

The trends in crop diversification clearly shows that the relative share of area under rice, wheat has increased considerably, while in case of cotton the increase is marginal. In the Rabi season the area is diversifying from gram to wheat since 1980-81. In kharif crops, area under rice and cotton increased, while area under bajra, jowar, maize, sesamum, and groundnut declined in all periods. It is evident that the area has shifted from bajra, maize, sesamum, groundnut to rice and cotton.

In the case of Haryana the area under coarse cereal and pluses is shifting towards rice, wheat, cotton and vegetables since 1980-81. Even area under vegetables are not analyse in the study directly. Yet on the basic of the study, it finds that the area is diversifying towards rice, wheat and vegetable because in this study, it has been analysis almost crops which sown in Haryana except vegetable. However vegetables have not studied, yet the study shows that the area under vegetables is increasing. In this study the area which is not included in fifteen crops is analyse by taking a concept of other crops. On the basic of other crops the study analysis the almost area which is under vegetables and other related activities.

The table 6.1 shows the percentage area under different crops in 1980-83, 1990-93 and 2004-07 and growth in percentage area. The present find that the area under rice rose from 8.9 percent to 11.6 percent from 1980-83 to 1990-93 and later it increased 15.9

percent in 2004-07. It shows that the share of area under rice became approximately double from 1980-83 to 2004-07, while the area under wheat increased from 28.6 percent to 32.4 percent from 1980-83 to 1990-93 and later it rose 35.7 percent in 2004-07. On other hand area declined in case of coarse cereals and pluses. The share of area under bajra decreased from 15.11 percent to 10.4 percent from 1980-83 to 1990-93 and later it became 9 percent in 2004-07. The share of area under Sugarcane shows a marginal declining trend while the share of area under cotton registered a marginal growth from 6.6 to 8.9 percent from 1980-83 to 2004-07. It showed that both rice and wheat gained 6 percent more area while nine crops lost 15.5 percent area from 1980-83 to 1990-93. In 2004-07 the share of area under both crops is 51 percent while the share of nine crops comes down by 13 percent in 2004-07. *(See table no 6.1)*

The highest area shifted from gram to other crops by 12 percent from 1980-83 to 2004-07. The highest area shifted towards rice by 8 percent followed by wheat by 7 percent and those crops which area not under this study that area calculated by other crops (all vegetable) by 8 percent from 1980-83 to 2004-07. *(See table no 6.1)*

Table No: 6.1 Percentage increase and decrease in Area

Rabi Crops				Kharif Crops			
CROPS	**1980-83**	**1990-93**	**2004-07**	**CROPS**	**1980-83**	**1990-93**	**2004-07**
Wheat	28.6	32.4	35.7	Rice	8.9	11.6	15.9
Gram	13.7	7.7	1.8	Cotton	6.6	8.8	8.9
RP SEEDS*	3.3	0.3	0.1	Bajra	15.1	10.4	9.1
Barley	2.0	0.9	0.4	Maize	1.2	0.5	0.2
				Jowar	2.2	2.0	1.4
				Sugar cane	2.4	2.6	2.0
Other	15.5	22.1	23.8	Other	15.5	22.1	23.8

DataSource: Statistical Abstrracts of Haryana (1980-81 to 2007-08).

RP SEEDS* = Rape seed and mustard

There are two seasonal crops one rabi another kharif, wheat, gram, rape seed and mustard are rabi crops, while rice cotton, jowar, bajra, maizeand sugarcane are kharif crops. In rabi crops, the area declined in all crops except wheat. Wheat gained 4 percent more area from 1980-83 to 1990-93 and 3 percent from 1990-93 to 2004-07. While the area under gram declined by 12 percent from 1980-83 to 2004-07. In Kharif crops area under rice and cotton is increasing while area under bajra and maize is declined, sugarcane showed a marginal growth during eighties while it showed a marginal declined from 1990-93 to 2006-07. *(See table no 6.1)*

District wise, it is found that during 1980-81 the five districts, Jind, Hisar, Rohtak, Ambala, and Sirsa were more diversified districts while Karnal, Kurukshetra and Bhiwani were comparatively low diversified districts. Further, the relatively more developed district, like Karnal, Kurukshetra, Sonipat, and Faridabad registered low level of diversification from 1980-81 to 2006-07. It may be due to adaptation of rice-wheat cropping pattern system in these districts. The level of crop diversification is declining in almost all the districts. It shows that these districts are getting more specialised in few crops like rice wheat, and cotton. The growth in area shows the same trend that the area under rice, wheat and cotton is increasing while the area under coarse cereals and pulses is declining since 1980-81.

The study shows that among rabi crops, wheat, gram, rapeseed and mustard, the area under gram declined since 1980-81 while the area under wheat increased in all the time periods. It shows that the area is diversifying from gram to wheat since 1980-81. In kharif crops, area under rice and cotton increased while area under bajra, jowar, maize, sesame, and groundnut declined in all the time periods. It shows that the area shifted from bajra, maize, sesame, groundnut to rice and cotton.

This study find that in 1980-81 there were five districts, Jind, Hisar, Rohtak, Ambala, and Sirsa were more diversified districts while Karnal, Kurukshetra and Bhiwani were

comparatively low diversified districts. The study shows that the agricultural developed district, like Karnal, Kurukshetra, Sonipat, and Faridabad registered low level of diversification from 1980-81 to 2006-07. The level of crop diversification is declining in almost all the districts which show that the districts are getting more specialization in few crops like rice wheat, and cotton. The growth in area shows the same trend that, area under rice, wheat and cotton is increasing while the area under coarse cereals and pulses is declining since 1980-81.

References:

Ali, Mohmad Iqbal & Renuka, C (1992): "Impact of Irrigation on Returns to Scale – A Study in Different Localised Areas of a Project", *Indian Journal of Regional Science*, Vol. 24, No. 1, pp. 15 – 25.

Barah, B.C. (2000): "Strategies for Agriculture Development in North East India Challenges And Emerging Opportunity", *Indian Journal of Agriculture Economics*, Vol. 62, No 1.

Barbora, Saundariya & Mantra, Ratul (2001): "District-wise Study of Agricultural Production in Assam using Cobb-Douglas Production Function", *Indian Journal of Regional Science*, Vol.33, No. 1, pp. 33-37.

Bathla, Seema (2008): "Regional Dimensions of Inter Corp Diversification in India: Implications for Production and Productivity Growth", *Agriculture Situation in India,* March, pp. 601-619.

Bathla, Seema (2006): "Trade Policy Reforms and Openness of Indian Agriculture: Analysis at the Commodity Level", *South Asia Economic Journal*, 7:1, pp. 19 – 53.

Bhalla G S,(2007), Indian Agriculture Since Independence, Published by NBT. India,

India (2008),Information and Broadcarting, Ministary Government of India, New Delhi.

Chand Ramesh, Raju and S.S., and Pandey, L.M. (2007): "Growth Crisis in Agriculture: Severity and Options at National and State Levels", *Economic and Political Weekly*, June 30.

Chand, Ramesh, Haque T, (1997), "Sustainabiity of Rice-Wheat Crop System in Indo-Gangetic Region", *Economic and Political Weekly*, March 29

Damodaran A. (2001): "WTO Agriculture Agreement, Common Property Resources and Income Diversification Strategy", *Economic and Political Weekly*, 22 September.

Desai, M. Bhupat (2002), "Policy Framework for Reorienting Agricultural Development", *Indian Journal of Agricultural Economics*, Vol. 57, No. 1, Jan-March.

Dev, Mahendra S and Rao Chandrasekhara (2005), "Food Processing and Contract Farming in Andhra Pradesh; A Small Farmer Perspective", *Economic and Political Weekly,* June 25.

Dileep, B.K., Grover, R.K. and Rai, K.N. (2002): "Contract Farming in Tomato: An Economic Analysis", *Indian Journal of Agricultural Economics*, Vol. 57, April – June.

Ghosh, Madhusudan (1998): "Agriculture Development, Agrarian Structure and Rural Poverty in West Bengal, *Economic and Political Weekly*, July 21, pp. 2987-2995.

Joshi, P. K. and Gulati, Ashok and Birthal Partap S, & Tewari Laxmi (2004): "Agriculture Diversification in South Asia patterns; Determinants and Policy Implications", *Economic and Political Weekly*, June 12, pp. 2457 – 2468.

Kumar, Parmod (2006): "Contract Farming through Agribusiness Firms and Corporation; A Case Study in Punjab", *Economic and Political Weekly*, December 30.

K., Sukhjit Saran and Sethi, Kiran (2000): "Fertilizer use in Indian Agriculture", *Indian Journal of Regional Science*. Vol. 32, No. 2.

Mahendradev, S. (1987): *Economic and Political Weekly*, September 26.

Mishra, R.S.: "The WTO Agreement on Agriculture (AoA) and Agricultural Crisis in India".

Madanani G M K,(1996), "Introduction To Econometrics: Principles and Applications", Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi

Nagar A L and Das R K,(1976), "Basic Statistic" Publised by Oxford University Press, New Delhi.

Sawant, S D & Achuthan, C V (1995): "Agricultural Growth across Crops and Regions Emerging Trends and Patterns, *Economic and Political Weekly*, March 15, pp. A2 to A13.

Sharma, R.K. (1990): "New Technology and Farm Size Efficiency: A Case Study of Haryana", *Indian Journal of Social Science,* Vol. 3 .No. 1.

Singh, Karam & Kalra, S (2002): "Rice Production in Punjab: System varietals Diversity Growth and Sustainability, *Economic and Political Weekly*, July 27, pp. 3139-3147.

Singh, Parasar and Sing (1997): Econometrics and Mathematical Economics, Chand & Company Ltd.

Singh, Sukhpal (2002): "Contracting Out Solutions: Political Economy of Contract Farming in the Indian Punjab", *World Development*, Vol. 30, No. 9, pp. 1621-1638.

Soni, R.N. (1992): "Leading Issue in Agriculture Economics", Sohan Lal, Nagin Chand & Company

Thakur A. K and Padmadeo K. B. (2008) "Growth and Diversification of Agriculture", Deep & Deep Publications Pvt. Ltd, New Delhi

Venkarddy, Chennareddy (1967): "Production Efficiency in South India Agriculture", *Indian Journal of Agriculture Economics*, Vol.49, No.4, pp. 820.

Vyas, V.S. (1996): "Diversification of Agriculture and Food Security in the Context of New Economic Policy", Oct. – Dec., Vol. 51, No. 4.

Yadav, D.B. & Rai, K.N. (2001): "Perspective and Prospects of Sustainable Agriculture in Haryana", *Indian Journal of Agriculture Economics*, January- March, Vol. 56, No. 1, pp. 100 – 115.

APPENDIX I

TABLE A-1.1 TOTAL PRODUCTION AND PERCENTAGE CHANGE FROM 1980-81 TO 2005-06 AT POINT OF TIME

Crops	Production in 1980-81 (000)tones	Production in 1990-91 (000)tones	Production in 2000-01 (000)tones	Production in 2005-06 (000)tones	% increase in Production		
					1980-81 to1990-91	1990-91 to 2000-01	2000-01to 06-07
Rice	1259	1834	2695	3210	45.7	46.9	19.1
Wheat	3490	6440	9669	8857	84.5	50.1	-8.4
Jowar	48	65	23	24	35.4	-64.6	4.3
Bajra	484	526	656	679	8.7	24.7	3.5
Maize	83	49	34	34	-41	-30.6	0
Barley	181	107	118	76	-40.9	10.3	-35.6
Gram	455	469	80	70	3.1	-82.9	-12.5
Moong	3.2	5.8	1.8	6.1	81.3	-69	238.9
Masoor	11.6	10.8	4.9	4.3	-6.9	-54.6	-12.2
Foodgrains	6036	9559	13295	13005	58.37	39.08	-2.18
Oilseeds	188	638	563	835	239.36	-11.76	48.31
Total cotton*	643	1155	1383	1814	79.63	19.74	31.16
Sugarcane	4660	7800	8170	8180	67.4	4.7	0.1

*Total Production in thousand of bales of 170 k.g.

APPENDIX II

PERCENTAGE OF AREA UNDER DIFFERENT CROPS DURING 1980-81 TO 1989-90

PERCENTAZE OF AREA UNDER DIFFERENT CROPS										
CROPS	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
Rice	8.86	8.62	9.18	9.86	10.11	10.43	11.09	9.91	10.01	11.35
Wheat	27.02	26.67	32.33	31.36	30.93	30.37	31.47	36.94	30.39	32.90
Jowar	2.49	2.02	2.18	2.67	2.78	2.06	2.67	2.86	2.58	1.82
Bajra	16.13	14.55	14.66	14.76	13.58	11.60	13.67	10.34	13.08	10.99
Maize	1.35	1.26	1.05	1.04	1.12	0.98	0.96	0.87	0.73	0.73
Barley	2.20	2.10	1.54	1.33	1.22	1.57	1.22	1.33	1.06	0.91
Arhar	0.13	0.13	0.15	0.33	0.39	0.43	0.61	0.84	0.73	0.27
Gram	13.18	17.83	9.55	11.39	11.28	13.53	10.77	4.27	10.74	9.30
Moong	0.08	0.11	0.09	0.16	0.10	0.14	0.16	0.06	0.18	0.17
Masoor	0.42	0.48	0.39	0.34	0.29	0.47	0.41	0.31	0.27	0.27
Sesamum	0.04	0.08	0.05	0.07	0.10	0.11	0.11	0.06	0.08	0.09
Sugar cane	2.11	2.48	2.76	2.33	2.10	1.86	2.22	3.04	2.17	2.42
G.C.A.*	***5462***	***5856***	***5327***	***5688***	***5512***	***5601***	***5662***	***4686***	***6012***	***5651***

Data Sources: Statistical Abstract of Haryana, (1980-81 to 1990-91) ** Gross Cropped Area in 000 Hectares*

APPENDIX III

PERCENTAGE OF AREA UNDER DIFFERENT CROPS DURING 1990-91 TO 1999-2000

PERCENTAZE OF AREA UNDER DIFFERENT CROPS										
Years	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
Rice	11.17	11.49	12.01	12.98	13.50	13.89	13.68	14.86	17.14	17.96
Wheat	31.26	32.46	33.42	34.36	33.72	33.01	33.21	33.60	34.62	38.43
Jowar	2.19	1.85	2.02	1.55	1.87	2.11	2.14	2.17	2.04	1.86
Bajra	10.29	10.16	10.83	8.75	9.66	9.63	9.40	9.51	9.59	9.74
Maize	0.59	0.48	0.54	0.51	0.46	0.44	0.43	0.39	0.33	0.33
Barley	0.85	1.02	0.92	0.66	0.84	0.67	0.58	0.65	0.57	0.58
Arhar	0.88	0.93	0.91	0.87	0.63	0.34	0.74	0.58	0.65	0.21
Gram	10.97	5.48	6.61	6.97	6.79	6.31	5.67	5.76	5.65	1.67
Moong	0.18	0.12	0.17	0.10	0.12	0.12	0.21	0.23	0.30	0.19
Masoor	0.31	0.25	0.22	0.18	0.17	0.17	0.18	0.22	0.12	0.13
Sesamum	0.10	0.08	0.06	0.06	0.05	0.05	0.06	0.05	0.05	0.08
Sugar cane	2.50	2.89	2.36	1.92	2.02	2.41	2.67	2.31	1.98	2.27
G.C.A*	***5919***	***5570***	***5853***	***5815***	***5889***	***5974***	***6074***	***6143***	***6320***	***6029***

Data Sources: Statistical Abstract of Haryana, (1991-1992 to 2000-01) ** Gross Cropped Area in 000 Hectares*

APPENDIX IV

PERCENTAGE OF AREA UNDER DIFFERENT CROPS DURING 2000-01 TO 2006-07

PERCENTAZE OF AREA UNDER DIFFERENT CROPS							
Crop	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**
Rice	17.24	16.51	14.41	16.01	16.00	16.16	15.58
Wheat	38.51	36.94	36.05	36.53	36.14	35.40	35.66
Jowar	1.78	1.67	1.80	1.59	1.49	1.35	1.35
Bajra	9.94	9.40	8.17	9.88	8.86	9.10	9.30
Maize	0.25	0.29	0.25	0.27	0.25	0.25	0.22
Barley	0.72	0.48	0.48	0.43	0.39	0.41	0.49
Arhar	0.25	0.27	0.58	0.41	0.48	0.46	0.33
Gram	2.04	2.33	0.87	1.94	1.67	2.00	1.65
Moong	0.16	0.24	0.37	0.40	0.46	0.22	0.31
Masoor	0.12	0.14	0.09	0.10	0.13	0.08	0.06
Sesamum	0.07	0.08	0.15	0.06	0.06	0.07	0.06
Sugar cane	2.34	2.59	3.01	2.52	2.02	1.95	2.10
G.C.A*	***6115***	***6226***	***6289***	***6338***	***6425***	***6509***	***6674***

Data Sources: Statistical Abstract of Haryana, (2001- 02 to 2007-08) ** Gross Cropped Area in 000 Hectares*