

Regional Disparities in Agricultural Growth in Haryana

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2018**

DECLARATION

I hereby declare that the thesis entitled “**Regional Disparities in Agricultural Growth in Haryana**” submitted to Department of Economics Central University of Haryana in partial fulfilment of the requirement for the award of the degree of Doctor of Philosophy in Economics, is a record of original research work done by me under the supervision of Dr. Ranjan Aneja, Assistant Professor, Department of Economics, Central University of Haryana. The content of this thesis has not been submitted so far in part or in full for any degree or diploma in any other institution.

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CERTIFICATE

This is to certify that the thesis entitled '**Regional Disparities in Agricultural Growth in Haryana**' being submitted by **Anju Rani** to the Department of Economics, Central University of Haryana in partial fulfilment of the requirement for the award of the degree of Doctor of Philosophy in Economics is appears as a record of original work done under my supervision. It has not been submitted in part or full for award of any Degree/Diploma of this University or any other institution. I deem the present research work fit for evaluation.

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Table of Contents

	Page No
Declaration	i
Certificate	ii
Acknowledgement	iii-iv
List of Tables	v-vii
List of Figures	viii
 Chapter 1 Introduction	 1-13
1.1) Growth of Indian Economy	1
1.2) Sector-wise Share in GDP of India	2
1.3) Growth Rate of Agriculture and Allied Sector	3
1.3.1) State-wise Productions of Principal Food grains crops	5
1.4) Determinants of Agricultural Disparities	5
1.5) Concept of Productivity	7
1.6) Profile of Haryana	7
1.6.1) Physical Features of Haryana	8
1.7) Agriculture Economy of Haryana	11
1.8) Districts Covered	11
1.9) Objectives of Study	12
1.10) Scope of Study	12
1.11) Organisation of the Study	12
 Chapter 2 Review of Literature	 14-41
2.1) Review of Theoretical Studies	14
2.2) Review of Empirical Studies	15
2.2.1) Global Level Studies	15
2.2.2) Indian Level Studies	18

	2.2.3) Regional Level Studies	29
	2.3) Research Gap	40
Chapter 3	Research Methodology	42-47
	3.1) Data Collection	42
	3.2) Research Methods	42
	3.3) Co-efficient of Variations	43
	3.4) CAGR (Compound Annual Growth Rate)	43
	3.5) Convergence Model	43
	3.5.1) σ - Convergence	44
	3.5.2) β - Convergence	45
	3.6) Regression Analysis	46
	3.6.1) Multiple Linear Regression Model	46
	3.7) Multicollinearity	47
Chapter 4	Regional Disparities of Agricultural Determinants in Haryana	48-87
	4.1) Introduction	48
	4.2) Disparities in Agriculture Production and Agricultural Inputs in Haryana Zone-wise	48
	4.3) Disparities in Agriculture Production and Agricultural Inputs Districts-wise in Haryana	75
Chapter 5	Disparities in Agricultural Growth in Haryana	88-120
	5.1) Introduction	88
	5.2) Area Under Cultivation of Various Crops	88
	5.2.1) Area Under Food grains	90
	5.2.2) Area Under Cash Crops	91

5.3)	Production of Various Crops	93
5.3.1)	Production Under Food grains	93
5.3.2)	Production Under Cash Crops	98
5.4)	Productivity of Various Crops	98
5.4.1)	Productivity Under Food grains Crops	101
5.4.2)	Productivity Under Cash Crops	102
5.5)	District-wise	103
5.6)	Sigma Convergence	109
5.7)	Beta Convergence	118
5.8)	Conclusion	120
Chapter 6	Impact of Agriculture Inputs on Agricultural Production in Haryana	122-127
6.1)	Introduction	122
6.2)	Multiple Linear Regression Model	122
Chapter 7	Major Findings and Recommendations	128-136
7.1)	Introduction	128
7.2	Major Finding	129
7.3)	Recommendations	134
7.4)	Limitations of the Study	135
7. 5)	Future Research Directions	136
	Bibliography	137-146

LIST OF TABLES

Table. No	Particulars	Page No.
1.1	Characteristics of the Indian agriculture sector	4
1.2	Compound Growth Rate of all India Area, Production and Yield of Food-grains	5
1.3	Agro- Ecological Regions in Haryana	11
4.1	Percentage of Net Area Under Irrigation in Haryana	50
4.2.1	Sources of Irrigations in Haryana Zone-wise	52
4.2.2	Percentage Shares of Total Area Irrigated in Haryana (Crops-wise)	54
4.2.3	Crop-wise Percentage Shares Zone-wise of Area Under HYV seeds	58
4.2.4	Rainfall in Haryana Zone-wise (in centimetre)	59
4.2.5	Percentages Shares of Fertilizer Consumption in Haryana Zone-wise	62
4.2.6	Zone wise Percentage Shares of Consumption Pesticides in Haryana	65
4.2.7	Zone-wise Percentage Shares of Tractors in Haryana	66
4.2.8	Targets and Actual Disbursement to Agriculture by banks (rupees crore)	69
4.2.9	Percentage Shares of Agricultural Credit Societies in the Haryana for the years 2001-02 to 2014-15	70
4.2.10	Percentage Share of Agriculture Credit Societies in Haryana	71
4.2.11	Percentages Shares of Agriculture Credit Societies (Share Capital and Own Capital)	72
4.2.12	Percentage Shares of Agriculture Credit Societies (Working Capital and Loan Advanced)	73
4.2.13	Percentage Shares of agriculture Credit Societies (Loan Recovered and Over dues)	74
4.3.1	District-wise Percentage Shares Canal Irrigation in Haryana	76
4.3.2	Percentage Shares of Tube-well Irrigation in Haryana District-wise	77
4.3.3	District-wise Number of Agriculture Credit Societies in Haryana	78
4.3.4	District-wise Own Capital Under Agriculture Credit Societies in	80

	Haryana	
4.3.5	District-wise Working Capital Under Agriculture Credit in Haryana	81
4.3.6	District-wise Loan Advanced Agriculture Credit Societies in Haryana	83
4.3.7	District-wise Loan Recovery Under Agriculture Credit Societies in Haryana	84
5.2.1	Area Under Cultivation of Food grains Crops in Haryana	89
5.2.2	Area Under Cultivation of Cash Crops in Haryana	92
5.3.1	Area Under Cultivation of Cash Crops in Haryana	94
5.3.2	Production Under Cultivation of Cash Crops in Haryana	97
5.4.1	Productivity Under Cultivation of Food grains Crops in Haryana	99
5.4.2	Productivity Under Cultivation of Cash Crops in Haryana	102
5.5.1	District-wise CAGR (Area Under Cultivation of Food-grains crops)	103
5.5.2	District-wise CAGR (Area Under Cultivation of Cash Crops)	104
5.5.3	CAGR (Production Under Cultivation of Food-grains Crops)	105
5.5.4	District-wise CAGR (Production Under Cultivation of Cash Crops)	106
5.5.5	District-wise CAGR (Productivity of Food-grains Crops)	107
5.5.6	CAGR (Productivity of Cash Crops)	108
5.6.1	σ –Convergence for Area, Production and Productivity of Food-grain Crops in Haryana Zone-wise	110
5.6.2	σ –Convergence for Area, Production and Productivity of Cash Crops Zone-wise	110
5.6.3	σ –Convergence for Area, Production and Productivity of Food-grains Crops in Haryana District-wise	114
5.6.4	σ –Convergence for Area, Production and Productivity of Cash Crops District-wise	114
5.7.1	β –Convergence of Food grains Crops District-wise	118
5.7.2	β –Convergence of Cash Crops District-wise	119
5.7.3	β –Convergence of Food grains Crops Zone-wise	119
5.7.4	β –Convergence of Cash Crops Zone-wise	119
6.1.1	Impact of Agricultural Inputs on Total Production in northern zone	123

6.1.2	Impact of agriculture inputs on Total Production in Central zone	123
6.1.3	Impact of Agricultural Inputs on Total Production in Western zone	124
6.1.4	Impact of Agricultural Inputs on Total Production in Southern zone	125
6.2.1	Multicollinearity in Impact of agricultural inputs on total production in northern zone of Haryana	125
6.2.2	Multicollinearity in Impact of agricultural inputs on total production in central zone of Haryana	126
6.2.3	Multicollinearity in Impact of agricultural inputs on total production in western zone of Haryana	126
6.2.4	Multicollinearity in Impact of agricultural inputs on total production in Southern zone of Haryana	127

LIST OF FIGURES

Fig. No.	Particulars	Page No.
1.1	Sector-wise Shares in GDP at constant (2004-05) prices	3
4.1	Total Fertilizers Consumption in Haryana Zone-wise	59
4.2	Pesticides Consumptions in Haryana Zone-wise	65
5.1	Standard Deviation of Area Under Cultivation of Food- grains Crops across Districts of India during 2001-2015	111
5.2	Standard Deviation of Area Under Cultivation of Cash Crops across Districts of India during 2001-2015	111
5.3	Standard Deviation of Production Under Cultivation of Food grains Crops across Districts of India during 2001-2015	112
5.4	Standard Deviation of Production Under Cultivation of Cash Crops	113
5.5	Standard Deviation of Productivity Under Cultivation of Food grains Crops across Districts of India during 2001-2015	113
5.6	Standard Deviation of Productivity Under Cultivation of Cash Crops across Districts of India during 2001-2015	113
5.7	Standard Deviation of Area Under Cultivation of Food grains Crops across Districts of India District-wise during 2001-2015	115
5.8	Standard Deviation of Area Under Cultivation of Cash Crops across Districts of India District-wise during 2001-2015	115
5.9	Standard Deviation of Production Under Cultivation of Food grains Crops across Districts of India during 2001-2015	116
5.10	Standard Deviation of Production Under Cultivation of Cash Crops across Districts of India during 2001-2015	116
5.11	Standard Deviation of Productivity Under Cultivation of Food grains Crops across Districts of India during 2001-2015	117
5.12	Standard Deviation of Productivity Under Cultivation of Cash Crops across Districts of India during 2001-2015	117

CHAPTER-1
INTRODUCTION

CHAPTER-1

INTRODUCTION

Agriculture is the mainstay of Indian economy as about 65 percent of Indian population depends directly on agriculture. India needs to support 17 per cent of the population with only 2.3 percent of the geographical area and 4.2 percent of the water resources. The net sown area is 140 million hectare and gross cropped area is 192.2 million hectare. Agriculture development is a necessary condition for the over-all development of the economy. A progressive agriculture has potential of achieve constant economic growth. It helps in achieving the developmental goals of eradication of poverty and modernization of society. The development of agriculture seems to hold the key progress to our economy as a whole. India's food grains production has increased from 94.9 million tonnes to 205.2 million tonnes in the almost four decades 1971 to 2009. The production of the food grains is possible with the Agricultural Strategy applied in 1966-67 and also some economic reforms in the country.¹

There is uneven growth of food grains since independence across different states of India during the period 2002 to 2011, the three states; Uttar Pradesh, Madhya Pradesh and Punjab altogether had, on an average, produce 42% of the total food grains production of the country. Only five states have exceeded their food share production. Moreover, impressive growth of food-grains and agricultural output has profound implications in terms of rural income and employment generation.

1.1) Growth of Indian Economy

During the 1980s, the process of diversification produce fast growth in non-food grains such as fishery, milk, vegetables and fruit which also helps to accelerated agricultural growth. The

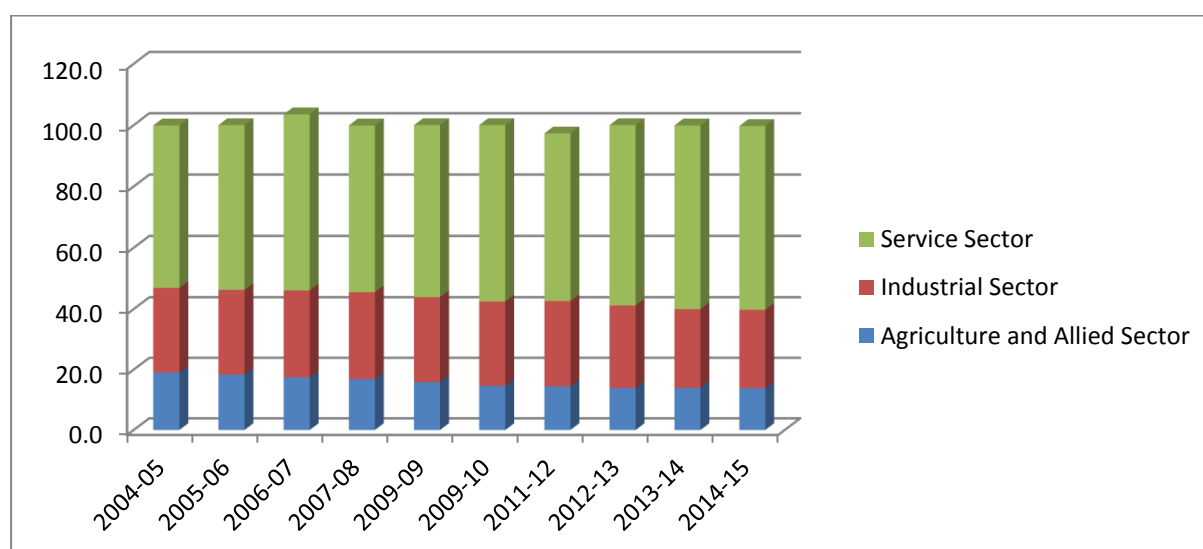
¹ Chaterjee, T. (2014). Spatial convergence and growth in Indian agriculture: 1967-2010. *Indira Gandhi Institute of Development Research* , 1-24.

GDP of agriculture increased annually at more than 3 percent during the 1980s which was considered a reasonably satisfactory performance of this sector. But this pace of growth in agriculture sector couldn't be maintained subsequently during the process of economic reform. During 1991, the country initiated economic restructurings that focused on extensive changes in regulations, policy on fiscal as well as trade, exchange rate, and private sector participation, government controls and market interventions.

The contribution of agricultural sector to GDP has declined over the years, whereas other sectors, particularly services, as increased. Agriculture sector contributes almost 17.2 percent of India's GDP, while the secondary sector contributes almost 26.4 percent of GDP and provides employment to about 14 percent of the population during the period 2015-16. The tertiary sector contributes almost 57.2 percent of the nation's GDP, employing about 34 percent of the population during the period 2015-16. The agriculture slowdown may seriously impede the employment generation and poverty alleviation in India (Mellor, 2000, and Singh, 2003).

1.2) Sector wise Shares in GDP of India

Figure 1.1 Sector wise Shares in GDP of India (2004-05 to 2014-15)



Source: Central Statistical Organisation

Figure 1.1 shows the share of agriculture & allied Sector in the GDP has also decreased from 19.0 percent in 2004-05 to 13.8 percent in 2014-15 whereas the share of services has increased from 53.0 percent in 2004-05 to 59.9 percent in 2014-15. Industrial sector decreased from 27.9 percent in 2004-05 to 26 percent in 2014-15.

The area under food grains is recorded to be 41.34 lakh hectares in 2016-17 as against 41.36 lakh hectares in 2015-16, showing a marginal decline of 0.05 percent .The total production of food grains in 2016-17 is estimated at 156.85 lakh tonnes while it was 143.78 lakh tonnes in 2015-16 showing an increase of percent. However, since the early 1990s, liberalization and globalization have become core elements of development strategy of the government. “These measures would create a potentially more profitable agriculture, which would be able to bear the economic costs of technological modernization and expansion” (Singh, 1995)². The reforms have been improved terms of trade in favour of agriculture but growth in agricultural sector has been fallen short of targets and has been well below that of non-agricultural sectors and the gap between rural and urban incomes has been widening.

1.3) Growth of Agriculture & Allied Sectors of India

Economic growth is related to a quantitative sustained increase in the country’s per capita output or income accompanied through expansion in its labour force, consumption, capital, and volume of trade. The growth of GDP agriculture sector was decreased with 5.10 percent in 2004-05 and 4.75 percent in 2014-15, whereas, overall GDP was 9.50 percent in 2004-05 and 4.71 in 2014-15. Performance of agriculture also provides employment and food security in India. Agriculture sector provides employment about 52 percent workforces. All India compounded annual growth of employment was 1.6 percent. Annual growth of employment

²Singh(1995), The Interaction between social protection and agriculture, *Indian Journal of Agricultural Economics* .

was highest in Punjab with 2.6 percent and lowest in Haryana with 0.6 percent in comparisons to India during the same period.

Table 1.1 Characteristics of the Indian agriculture sector

	Land	India rank in world production
Arable land (in million hectare)	151	2
Irrigated Land (in million hectare)	55	1
Wheat (in million tonnes)	72	2
Rice (in million tonnes)	124	2
Coarse grains(in million tonnes)	29	3
Milk (in million hectare)	91	1
Fruits (in million hectare)	47	2
Vegetables (in million hectare)	82	2
Edible oilseeds	25	3
Pulses (in million tonnes)	15	1
Sugarcane (in million tonnes)	245	2
Tea (in million hectare)	85	1
Source : Ministry of Agriculture, Government of India		

The table 1.1 shows area and production of different agriculture products along with its India's rank in the world population. India total arable land is 151 million hectare where its rank is 2nd and data shows that India stands at 1st rank on Irrigated land production. India's stand on 1st rank in the production of milk, pulses and tea worldwide where its total area for these commodities is 91, 15 and 0.85 respectively. On the other hand for India is at 2nd rank in the production of wheat, rice, sugarcane and cattle in the world. Total area under the production of fruits is 47 hectare and areas under production of vegetables are 82 hectare with 2nd rank.

Table 1.2 Production of principal food grain crops in India (Million tonne)						
Years	2004-05	2010-11	2011-12	2012-13	2013-14	2014-15
Rice	83.10	96.00	105.30	105.20	106.70	104.80
Wheat	95.00	120.00	127.30	123.30	127.10	118.10
Total cereal	185.20	226.30	242.20	238.20	245.80	235.50
Pulses	3.10	18.20	17.10	18.30	19.30	17.20
Total food grains	198.40	244.50	259.30	257.10	265.00	252.70
Oilseeds	243.50	324.80	298.00	309.40	327.50	266.80
Source: Ministry of Agriculture, Government of India						

The table 1.2 shows production of food-grains crops in India. Production of rice is increased 83.10 to 106.70 lakh million tonne between 2004-05 to 2013-14. Production of wheat and total cereal also increased between 2004-05 to 2013-14. Production of pulses increased 3.10 lakh million tonne to 19.30 lakh million tonne between 2004-05 to 2013-14; it was decreased by 17.20 lakh million tonne during 2014-15. Total food grains production increased 198.40 to 265 lakh million tonne during 2004-05 to 2013-14.

1.3.1) State-wise production of principal food grains & non food grains crops

Total food grains production of Haryana was 16293 thousand tonne during the period 2015-16 which is 15236 thousand tonnes higher than that of the last year production. Production of rice was 4145 thousand million tonnes, 11352 thousand tonnes. Oilseeds production during 2015-16 was 855 thousand tonnes, sugarcane production is estimated at 7169 thousand tonnes and cotton production is recorded at 993 bales (170 kg. each bale).

The share of rice production is higher in Andhra Pradesh, Punjab, Uttar Pradesh, and West Bengal with 12.1 percent, 9.2 percent 12.5 percent and 14.7 percent respectively among the all states during the period. The share of wheat production was noted in Haryana, Punjab and Uttar Pradesh with 11.5 percent, 20.4 percent and 33.4 percent respectively. The higher share

in crop pulses was in Maharashtra, Madhya Pradesh and Uttar Pradesh. Whereas the higher share in food grain production was noted by, Andhra Pradesh, Madhya Pradesh, Punjab and Uttar Pradesh among the all states with 16.3 percent, 8.3 percent, 11 percent and 19.6 percent respectively.

The cotton and sugarcane are important cash crops in the nation recorded positive but broad disparity compared to other crops. The Gujarat, Maharashtra and Punjab were recorded highest share in cotton production with 22.8 percent, 20 percent and 14 percent. These three states were producing 67 percent production out of total cotton production. The Uttar Pradesh, Andhra Pradesh, Maharashtra, and Tamilnadu were recorded higher percentage share in sugarcane.

1.4) Determinants of Agricultural Disparities

Regional disparities refer to unequal growth of primary, secondary and tertiary sectors in a nation, state or district. A number of factors are affecting the disparities such as market, agronomic conditions, and availability of fertile soil, irrigation facilities and climate conditions. Moreover, agro economic conditions and technical availability are the more important factors which facilitate crop disparities.

In this study, the most of the determinants responsible for disparities are included such as total cultivated area; annual rainfall, Irrigation facilities, and pesticides, fertilizers used per hectare, tractors and agricultures credit. Fertilizers are substances containing a chemical element that improves the growth of plants. Pesticides increased economic potential and also improved the vector-borne diseases, and it resulted the serious health implications to man and his environment. Most rain water is used in agriculture for crop production.

Three major channels for disbursement of formal credit include commercial banks, cooperatives and micro-finance institutions (MFI) covering the whole length and breadth of the country.

1.5) Concept of Agricultural Productivity

Agriculture productivity is a relationship between the quantity and quality of goods and services produced and the quantity of resources used to produce. (Prokopenko, 1987). The concept of productivity has two measurements: total factor productivity (TFP) and partial productivity. The total factor productivity is the relationship between output produced and an index of composite inputs; meaning the sum of all the inputs of basic resources particularly labour, capital goods and natural resources.

Krugman (1990) asserted that “productivity is not everything, but in the long run it is almost everything”.³

Productivity = total output/total input which is identical to total results achieved/total resources consumed or effectiveness/efficiency.

1.6) Profile of Haryana

The state of Haryana was a major contributor to the “HaritKranti”, so called “Green Revolution” which was a good merged of traditional and modern culture, situated in the northern part of India. Haryana is bound by Uttar Pradesh in the east, Punjab in the west, Himachal Pradesh in the north and Rajasthan in the south. The geographical area of the Haryana is 44212 sq k.m which is 1.34 percent of the total geographical area of India. At present there are only three rivers in the state the Yamuna, the Ghagar, the Markanda. The growth rate of agriculture sector in the State income grew after independence on this sector. Further, the green revolution took place in the State giving a major help to the growth of

³Krugman, P. (1990) “The Age of Diminished Expectations” MIT Press, Cambridge, Mass., p.9.

agriculture sector (Government of Haryana, 2013-14). Wheat, rice, cotton, bajra, maize, gram and jowar are the main crops of Haryana.

Population of Haryana was 25351462 persons in 2011. The relative share of rural population and urban population to the total population were 65.20 percent and 34.79 percent respectively for the year 2011. The density of population was 570 persons per sq. k.m. In the social indicators of the State in 2011, the birth rate in rural and urban areas was 22.6 and 19.2 per thousand while combined birth rate of rural-urban was 21.6 per thousand. Whereas the birth rate of rural and urban areas of India was 23.7 and 18.0 per thousands and combined birth rate of rural and urban were 22.1 per thousand. The literacy rate was 75.55 percent and separately for male and female literacy rate was 85.38 percent and 66.77 percent respectively which more is as compare to literacy of India. The infant mortality rate of the state is 42 per thousand as compared to 47 per thousand at India level. The sex ratio of Haryana was 879 females for per thousand males, which is lowest in the country

1.6.1) Physical Features of Haryana

Haryana can be divided into two regions, the plains and hills. The plains covers the entire state except the southern part of Mahendergarh district, the south western part of Gurgaon district and north – eastern part of Panchkula district. The arawali range is narrow ridge stretching into Haryana for 90 kms. In the northeast and south west directions up to Delhi. It covers the southern parts of Mahendergarh and adjoining areas of Gurgaon district. In the south western part of Haryana plains a great deal of wind blows and sands pile up in the form of sand.

At the time of its formation, the state comprised seven districts named, Gurgaon, Mahendergarh, Rohtak, Hisar, Karnal, Jind and Ambala. At present there are 22 District, 93 Tehsils or 49 sub-Tehsils, 154 towns, 71 sub-divisions, 4 divisions (Such as Ambala, Gurgaon, Hisar and Rohtak), 140 blocks, 43 Universities, and 6841 villages with total areas of

44,212 square kilometres. According to census, it has a total population of 21,144,564. The literacy rate is 75.6 percent (84.1 percent male, 65.9 percent female).

Infrastructure in Haryana

- Roads: Length in the state is around 27000 km.
- Airports: The Indira Gandhi International Airport at New Delhi nearby Gurgaon and Faridabad. Civil aerodromes at Pinjore, Karnal, Hisar, Bhiwani and Narnaul and airport at Chandigarh.
- Power: According to economic survey of Haryana, 2012-13, the generation capacity is 8728.36 MW and total power available stood at 293744 MW
- Railways: As of March 2011, Haryana had a railway-route length of 1,540 km. Kurukshetra, Rohtak, Jind, Hisar, Ambala, Panipat, and Gurgaon are some of the important railway stations. There is a railway workshop at Jagadhari.

HARYANA DISTRICT MAP



1.7) Agriculture Economy of Haryana

Haryana is the one of the smallest state in India. Haryana state can be divided into four zones, northern, western, central and southern. Southern zone has better irrigation facilities and good overall infrastructure. Western zone is having major area under millet, rapeseed and mustard. This zone is suitable for arid –horticulture. Mewat area is more suitable for agro- forestry, sheep and goat rearing.

Sangwan (1985) reported that changes in the state cropping pattern resulted from increase in irrigation facilities to a large extent. The diversity in soil, agro-climatic conditions in addition of canal irrigation availability and infrastructure services across the sub-regions, it has a potential to cultivate variety of crops in the state.

Table 1.3 Agro- ecological regions in Haryana (Lunkad& Sharma, 2008)					
Regions	Climate & Soil	Average rainfall	Average ground water quality	Districts	Crops
Arid (Western)	Hot and Arid with deserts with saline soil	350	>4000	Sirsa, Fatehabad, Hisar, Bhiwani, Mahendergarh and Rewari	Millet, Bareley, pulses, cotton*, maize, oilseeds, wheat, rice, sugarcane
Semiarid (Central)	Hot semiarid with alluvial soils	350-500	>1500-4000	Kathial, Jind, Rohtak, Jhajjar, Gurgaon	Wheat & rice with maize, cotton**, pulses, oilseeds and sugarcane
Semiarid (Eastern)	Hot semiarid with alluvial soils	500-600	<1500	Panchkula, Ambala, Karnal, Yamunanagar, Karnal, Kurukshetra, Panipat, Sonapat, Faridabad	Wheat & rice with maize, cotton, oilseeds and sugarcane
* not cultivated in Mahendergarh&Rewari districts					
** not cultivated in Mahendergarh&Rewari districts					

1.8) Districts covered

This present study is based on the district wise and zone wise data from 19 districts for the 2000-01 to 2014-15. The newly created districts Mewat, Palwal and Charkhi Dadri have not been included due to non-availability of separate dates of these districts. The information of these districts is included within their parental districts.

1.9) Objectives of study

1. To analyse the regional disparities in agriculture growth in Haryana.
2. To analyse the regional disparities in agriculture determinants in Haryana.
3. To study the impact of agriculture inputs on agriculture production in Haryana.

1.10) Scope of study

The pattern of agricultural development in Haryana is characterised by several serious distortions mainly due to unequal distribution of assured irrigation facilities, infrastructure across districts and the spread of new seed-fertilizer technology. This has led the incensement inter-district disparity in the growth of agricultural output in state. Therefore, the district wise analysis may be useful in assessing the progress of agriculture and may thus provide a future perspective in the light of the past experiences.

1.11) Organisation of the study

This study is divided in to seven chapters .The details of the chapters are given below:

Chapter-1: Introduction

This chapter deals with the introduction of the topic, significance of study and objectives of the study.

Chapter -2: Review of Literature

This chapter included theoretical and empirical literatures related to the study.

Chapter-3: Research Methodology

This chapter included sources of data, statistical technique which were used in the study.

Chapter- 4: Regional Disparities in Agricultural Determinants in Haryana

This chapter analysed disparities in agricultural determinants in Haryana zone- wise and district -wise.

Chapter -5: Regional Disparities in Agricultural Growth in Haryana

This chapter regional disparities in agricultural growth with area production and productivity of selected major food grain and cash crops in Haryana district-wise and zone-wise.

Chapter -6: Impact of Agricultural Input on Agricultural Production in Haryana

This chapter analysed the impact of agriculture inputs on agriculture production in Haryana.

Chapter-7: Major Findings and Recommendations

This chapter discuss the major findings, recommendation and further research directions of study.

CHAPTER-2
**REVIEW OF
LITERATURE**

CHAPTER -2

REVIEW OF LITERATURE

Regional disparities have become a have become a debated topic during the last two or three decades. Literatures showed regional disparity is a versatile conception, includes aspects such as inequality and convergence.

Review of literature in a research work is essential to develop construction of knowledge to ensure that the present study would be an introduction to the topic. It also provides the direction to the researcher.

2.1) Reviews of Theoretical Studies

Lewis (1954) developed theory of unlimited supply of labour. He divided underdeveloped economy into two sectors; one is the traditional and second is modern sector. The modern sector uses reproducible capital and profit maximization. The traditional sector was subsistence oriented and output per person is lower than in capital sectors. Lewis shows that if unlimited labour is accessible at fixed wage rate the surplus of capitalist would be raising proportional of national income. The subsistence sector adopt modern technique of production net wages would increase in the capitalist sectors. Therefore it decreases the capitalist surplus.

Solow-Swan (1956) gives the powerful intimation of convergence occurrences. This model is expended with human capital then rapidly convergence is excessive. This gives a batter clarification for distinction in income covering countries and regions. Population growth rate are recorded for convergence model (MRW, 1992). Therefore in this model, growth of per capita income is a purpose of basic factor of immovable state.

Johnston and Mellor (1961) analysed the role of agriculture in overall economic development in economy. They stated that supply of labour in agriculture is mandatory to

modern sector as well as mandatory to labour. An agriculture sector is main sources of saving for modern sectors. In underdeveloped countries with labour forces occupied in agriculture. The sources of growth of employment in primary sector are expanded yield technology increasing areas of agriculture land.

Matsuyama (1991) developed two sector growth models. The engine of growth, in this model was the operate, with self-perfection in the manufacturing sector. In case of the closed economy, an increase in agricultural productivity stimulant overall growth. In the contest of open economy is a negatively relationship among agricultural productivity and overall growth.

Kuznets (1995) analysed the relations among the per capita GNP and imbalance in the distribution of income would be take place the shape of 'U'. According to him income of per capita increase, inequality would also increase.

2.2) Reviews of Empirical Studies

2.2.1) Studies in Global context

Mrutyunjay and Das (2009) examined region wise disparities in development of agriculture in Orissa district in the pre & post reform period. They used agricultural development indices and 9 agriculture indicators by deprivation method for different districts of Orissa. This study also identified factors which are responsible for variation in agricultural productivity across districts. This study used regression equation for the yield rate of food grains in 13 districts of Orissa as (the dependent variable) and use of fertilizer, irrigation, rainfall and size of operation land holding as (the explanatory variable). This paper has been used secondary data which have taken from agriculture statistics Orissa. This study divided in four zone of district Orissa. This study found four districts are due to good irrigation facilities and broad tracts of fertile and plain land with alluvial soil. Districts of northern zone are found to be most backward districts. In the post reform period regional disparity in Orissa has been declined.

An analysis of the factors responsible for regional disparity in Orissa is that irrigation is the important factor of agricultural productivity. In Orissa irrigation facility has been provided to 45.62 percent of cultivable land and 54.38 percent is rain fed. This study found there is need to increase irrigation facility. This paper suggested to achieve optimum yield from irrigated water should be delivered to farmer's field in adequate quantity in time. Use of water, efficient and sustainable and distribution should be equitable. Development of ground water should be encouraged by providing in credit for institutional and interest at low rate, subsidised power supply and marketing facilities for sales of agriculture produce.

Xin and Qin (2009) examined dissolve the growth of agricultural labour productivity in like transform in regulations, progress in technology & contribution agriculture inputs per worker. This study found that efficiency to increased TFP growth in agricultural growth. Agricultural growth in china is a phenomenon of progress in production foundries. The loss in productivity gives crack documentation that spreading of prevail agricultural technique in China is inefficient.

This study suggests encouraging the agriculture development in China. Government should increase production of agriculture technology. And increase efficiencies of agriculture production in development of China's agriculture. The convergence found the instruments of disparate regions are divergent. The levels of agricultural labour productivity during the period are different for national sample. Per worker contribution of worker has convergence result on agricultural labour productivity.

Gorman and Pandey (2010) analysed account for the sources of disparities in agriculture productivity covering 79 countries. They recorded the highest disparities in agriculture labour productivity covering these countries and considerable increase in this disparity during the period. This study dissolve the sources of disparity in to a part that can be assigned to input use and one that can be assigned to the efficiency which farmers construct use of

determinants, taking into recorded the fact that determinants use. This paper founded disparities in land per worker, chemical and fertilizer. This paper showed correlation in agriculture input and agriculture productivity significantly. In particular they identified an important role for per worker agricultural machinery. This study recommendation that policy should be concentrated on empower farmers to obtain capital. The higher part discovered in this study for improved varieties of seed for increasing productivity of labour in the developing world which suggested that future research highest productive varieties is accreted.

Esposti (2011) studied disparities regional agricultural productivity in Italian region. This study examined agricultural Total Factor Productivity (TFP) growth in long-term at regional level with used time-series premises. And found factors associated with divergence as opposite to convergence. This study found technological is the key convergence intensity nevertheless of how the spillover effects are calculated.

Kumo (2011) investigates convergence in real per capita GDP and macroeconomic policy in southern Africa. Empirical tests found no proof of convergence in real per capita GDP in the SADC economies. ADF unit root test demonstrated that Botswana and South Africa's real per capita GDP converged. The study found that the economies of the member states have showed a tendency of macroeconomic divergence in 2009.

Motebennur (2012) examined spatial variations in agricultural productivity of Dharwad district in Karnataka state. This study has been made to determine agriculture productivity of major food crops in Dharwad district. This study used M.G. Kendall's ranking coefficient method. This study is used secondary data which have collected from the district statistics office, Dharwad for the year 2008-09, Government of Karnataka. This study found high agricultural productivity in Navalagund and Hubli talukas due to the irrigation facility extended by Mulaprabha river project, black cotton soil use of HYV seeds, fertilizers,

pesticides and the use of modern farm technology. In the medium range of agricultural productivity during 2008-09. There are two talukas, Dharwad and Kundagol, due to the low fertility of soil, lack of irrigation facility. The Kalaghatagi taluk falls under the low productivity region due to lack irrigation facility and traditional minds of farmer. Overall the agricultural productivity region in Dharwad district is under developed with influence of government facilities and programmes to be adopted.

Burja (2011) analysed inputs of the agricultural productivity growth in Romanian regions. Main objective of this study is to find out the factors that influenced agricultural labour productivity in territorial description. This study used a factor analysis model for farm net value added indicator on labour. The expansion of total agricultural productivity was performed with using efficiency scores determined with the Data Envelopment Analysis Method. This paper showed the determinants of productivity disparities in dynamic and territory. The performance of every one region was studied on the basis of absolute disparity of productivity compared of the indicator in the previous period and the level of the productivity variation founded from the individual action of influence factors.

Sharma (2017) analysed regional disparities in agricultural development in Aligarh district block level over the period. The study has been calculated by combining data related to various variables, percentage share of agricultural workers in total workers, fertilizers consumption, and percentage of tube well and agricultural instruments per thousand hectares. This study used Z- score development in blocks has been categorized. This study found that a technological input has corresponding relationship in agricultural development.

2.2.2) Studies in Indian context

Dev (1987) analysed adjusted and unadjusted growth rates in food grain production major states. This study used standard deviation for variation in output. This paper concludes that

there was advancement but marginal decline in instability at the all-India level. This study found the debate on instability was: after 1979-80 instability in food grain production at all-India level, it is decreasing from 11.41 percent for 1960-61 to 1969-70 to 11.16 percent for 1970-71 to 1979-80. This study concluded that the measures variability in all-India production of food grains did not show any significant.

Nagraj (1987) analysed the factors affecting use of fertilizer in agriculture in India. This study used regression and correlation analysis for fulfil objectives. Spread of HYVs and fertiliser-intensive crops are founded to have a positive impact on consumptions of fertilisers. This study suggested that irrigation is uniformly a dominant influence especially groundwater.

Dev (1988) analysed inter-state variations in agricultural productivity of labour. This paper examined the rural poverty and the agreements in productivity of labour and rural poverty. This study used co-efficient of variation and decomposition of labour productivity. This study found the estimates of labour productivity did bring out sharp variations in its levels. Coefficient of variation increased over the reference points indicating widening of the disparities in productivity of labour. The decomposition of productivity of labour revealed that yield was the major source for the rise in productivity of labour. The analysis on the sources of variability in the levels of productivity of labour shows that in the early 1960s, the contribution of land-man ratio to the variability in labour productivity was higher than that of land productivity. Relatively low variability in labour productivity in the early 1960s was due to the high negative covariance between land productivity and land-man ratio.

The variations in labour productivity and its estimates of rural poverty also revealed wide inter-state disparities in its levels and pattern of change. This study concluded that labour productivity increase through technological changes has had a positive impact on the levels of living of the population in rural areas.

Sharma (1990) examined agriculture performance in various states and the factors affecting performance of agriculture growth during 1966 to 1988. Exponential function has been used to work out the growth rates of production. The study revealed that four states viz. Punjab, Haryana, Uttar Pradesh and Maharashtra experienced growth rates higher than the national average of 2.72 percent per annum. Gujarat, Tamil Nadu and Rajasthan had non-significant growth in the production. Other states witnessed growth rates in food grain production lower than the national average. Tractor implementation pattern was found to be skewed as there was significant variation among different states. It was recommended that to minimize the inter-state disparities in growth of agriculture. The major policy should be on increasing facilities in irrigations in the states, which has lagged behind and to narrow down the adoption gap in the use of fertilizers in various states, which must be supplemented with credit from lending institutions.

Panda (1991) examined the inter-regional disparity and instability in agricultural growth created during a decade period from 1978-79 to 1987-88 in Orissa. Coefficient of variation was used to analyse the yield instability of the crops. Area under cereals showed negative while that under pulses and oilseeds showed positive growth at state level. The production growth was positive in all the three crop groups and it was higher in case of oilseeds compared to cereals and pulses in all the four regions (excepting the Eastern Ghats). Productivity of oilseeds had also performed better than that of cereals and pulses at the state level. Crop wise instability was observed to be maximum with oilseeds and minimum with pulses in almost all the regions during the period under study. The study revealed positive association between higher growth in yield and higher fluctuations in case of oilseeds.

Mundlak et. al. (1997) analysed determinants of agricultural production. This paper found are uniform with the vision that physical capital perform as a limitation to growth of agriculture. At the same time, regression showed that shift to more productive technique is

integrated with a decreasing in labour. This study found the importance of capital in agriculture production. Agricultural capital is an important input of agricultural production.

Bhalla and Singh (1997) analysed of state level area and output. This study found significant improvement in the patterns of levels and growth of agricultural. During the first 20 years, that is from 1962-65 to 1980-83, the effect of the new technology in transforming agriculture was restricted to the north-western and southern states. It revealed that there was acceleration in the agricultural output in India during 1980-83 to 1992-95 as compared with the earlier periods. In the central region, two major states, Madhya Pradesh and Rajasthan recorded very high growth. Despite a slow-down, region of the north-western continued to grow at a respectable rate. An analysis of input use in various regions of India including the eastern region shows that both high levels and growth of yield and output were brought about through increased use of fertilisers and increased investment in minor irrigation. This paper concluded there is a need to remedy the situation. In particular, development of institutional credit must receive high priority. However, agricultural growth and crop diversification was not accompanied by any significant change in labour force diversification.

Adabar (2002) examined growth in India through the convergence implications of neoclassical growth. Here attempted to re-examine economic growth and convergence on focusing on the differences in the 14 major states of India. Population growth rate and human capital along with state particular impact are managed for, and then there has been proof of conditional convergence at the rate around 12 % per five-year. Here focused of policy activism to achieve balanced growth and regional convergence.

Haque (2003) examined on reforms in growth of agriculture and rural development. This paper focused on contract farming which could accelerate the growth of agriculture. The farmers get profit because of his access to technology, inputs quality, self confident price, and market supports. It suggested that, land leasing policy should be to promote contract farming.

Chand and Kumar (2004) examined factors of capital formation and agriculture growth. This paper measured a simultaneous equation model with private and public sector capital formation and GDP agriculture. This study found impact of agriculture subsidies on private investments is also positive. Increase in public investment convenience a rise in private investments. Public sector investments mainly depend upon fiscal resources. This study also found the incensement in subsidies of farm and decreasement in receipts of revenue from agriculture. The study showed that trade-off between transferred resources to agriculture on the revenue account.

Ghosh (2006) examined convergence in Indian agriculture in India. It specifically investigates whether there is existence of convergence in productivity of land and labour. This study recorded the regional convergence or divergence in land and labor productivity. Conditional β -convergence showed significant inter-state disparities in the steady-state levels of productivity of land and labor. The study found the importance of higher growth rates and steady-state levels of productivity of agriculture.

Ghosh (2008) examined economic performance of fifteen major states. This paper examined convergence or divergence across the states in 1960-61 to 2001-02. The main finding of the study was related to strong tendencies to diverge during the post reform period in per capita income. Author found existing policy modifications in economic reforms for reducing regional disparities in per capita income.

Mathur et. al. (2007) explained that there were highest disparities in growth of food grains in agriculture. Their results showed that for the period 1990-91 to 2003-04, public investment and subsidies included in agriculture by the government expenditure. Prices of Agriculture had a positive effect on food grains production. Variables exogenous rainfall and population were also important. At same time, the state-wise analysis from the panel regression result

showed that the agricultural output at current prices was significantly and positively dependent on agriculture.

Balkrishan et. al. (2008) examined the agricultural growth in India since 1991. This study focused on the slow growth of Indian agriculture sector since 1991. They took in to consideration relevant variables to study agricultural growth for the study period. The first was about the agriculture and economic reforms. This study argued that, there is nothing intrinsic to the policy of liberalization of an economy in the form of trade and industrial policy reforms that must be damaging of agricultural. The second section examined agriculture growth since 1991. This study took in to consideration relevant variables to study agricultural growth for the study period. The first was about the agriculture and economic reforms. This paper argued that, there is nothing intrinsic to the policy of liberalization of an economy in the form of trade and industrial policy reforms that must be damaging of agriculture.

The second section showed the percentage, growth of areas, product and yield from 1950-51 to 2005-06. The third section examined some variables like relatives price change, import liberalization, import penetration. The fourth section was about the non-price factor like capital formation, land holdings, expansion and public expenditure on irrigation, public research and extension activities examined by the researcher and lastly they concluded and made some policy implication.

Khomiakova (2008) studied regional divergence in India. This study used exploratory spatial data analysis and structural divergence. This study found income in services sector and industry has positive autocorrelation.

Gaur (2010) analyzed regional disparities in economic growth in India. There are huge gap between active and vibrant regions during the pre-independence period in context of

availability of facilities. After independence, decreasing in inter-state disparities has been focused during Five Year Plans. Inter-state disparity for the period 1980-2002 has been examined with the help of inequality indices that are based on properties of Lorenz curve. Inter-state inequality trend has also been examined through 'sigma convergence and beta convergence.

Hasmi and Iqbal (2010) studied growing inter-state disparities in Indian agriculture. The main objectives of the study are to suggest suitable measure to reduce regional disparities in Indian agriculture. This study found the better performing in western and southern areas and in northern and eastern regions. The variation in the number of tractor use and in cropping intensity has positive impact on the variation in agriculture output. This paper suggested agricultural disparity is found positively associated with the variation in the level of infrastructure, fertilizer consumption and farm mechanisation. The public sector should concentrate on educational programmes for farmers, facility formation of farmer groups. The state government have to make substantial enhancement in watershed management, irrigation and flood control, especially in those state where frequency of such occurrences is very high.

Kumar et. al. (2010) studied inter district variations in the average yield of selected crops in the state of Haryana. This paper selected crops of rice, wheat, gram, barley and potatoes. To determine the factors responsible for the increase in average yield of crops in Haryana used multiple regression models. This study found the average yield of major crops at national level very significant, there is need to strengthen infrastructure relating to agriculture sector. In the state of Haryana different districts have distinct advantage to raise various crops depending upon agro climate conditions. This paper suggested that there is need to strengthen the infrastructure relating to agriculture sector. More capital formation needs to be done in rural sector. There is need to formulate policies for the improvement of yield of different crops. Credit facilities should be provided to farmers at appropriate.

Nandi (2010) examined inter-state and inter-regional disparities in food grain in India. For measuring the disparities in production of food grains as well as of different crops she used coefficient of variation. Author used T - Statistics for convergence and divergence. This study found the overall improvement in the growth performance of eastern India has been an important development that has positively affected the overall performance of the Indian agriculture during the 1990. Disparities in crop of rice increased from 0.09 to 0.12 percent during the period. Disparities of crop wheat decreased between 1950-51 to 1962-63 and increased between 1962-63 to 1966-67. During the 1989-1990 growth rate for both food grain and non food grain declined from 3.72 to 2.35 percent.

Panda (2010) analysed the inter-state disparities and irrigation in the post-reform period, to measure the relationship between irrigation and agricultural development and to examine the inter-state inequity in distribution on gross cropped area and credit employment in commercial banks. This study covered the period 1992-93 to 1999-2000. This study used compound average growth rate and gini coefficient of concentration for measure the extent of inequality in the share of gross cropped area. He found all India level acreage under canal irrigation has declined while that underground water irrigation has gone up. For Bihar and Maharashtra area under canal irrigation has gone up while that underground water has fallen. In case of developed state like Gujarat, Haryana, Karnataka, Punjab. The value of gini coefficient of concentration in regard to credit distribution among states has also found to have increased from 0.322 to 0.350 percent between 1995-96 and 1999-2000 respectively. This paper suggested that there has need for stepping up direct credit to farmers by the institutional agencies.

Thakur (2010) studied inter-regional disparities in a comparative study of agricultural development in each zone state. This paper focused on some key issues-like use of fertilizer by the UP, Andhra, Bihar and Gujarat states. Regional imbalance in fertilizer is state wise

consuming about 22 percent, of total fertilizer consumption of India followed by Andhra Pradesh, Bihar and Gujarat come lower consuming states in comparison northern and southern zone. This paper suggested desired agriculture growth. And have to increase fertilizer consumption in state Uttar Pradesh and Andhra Pradesh. In each state where the agricultural production is low can be diversified with Pisciculture, Sericulture and Floriculture will also provide market rates for agricultural produce at state level.

This study also found Punjab is famous for rice, major producer of wheat, Andhra Pradesh is famous for Tobacco and cotton, Bihar is famous for paddy, fruit and Gujarat is famous for cotton and sugarcane.

Asayehengn (2012) examined the effect of small-scale irrigation on household income. This study was based on both primary and secondary data. This study found the income of mean irrigation consumer to non-consumer exceed with 37.03 percent. This study concluded that livestock and utilization to working capital is factors for irrigation utilization.

Maan et. al. (2012) examined growth and performance in agriculture sector. State wise data in term of total gross area, irrigated area and population have been collected by schedule commercial bank. Data have been used for the year 1995 to 2009. Growth rate were used for analysing the data. This study found distribution of fertilizers, advances to the state and direct finances given by the nationalized banks growth rates were significant .The high growth rate areas of above 80.34 percent included the State of Jammu & Kashmir, Meghalaya, Nagaland, and Tripura. Gini coefficient showed that distribution of loans to state electricity boards, gross irrigated area not changed during period the time. The inequality in distribution of loans to distribution of fertilizers and other inputs in relation to net irrigated area had decreased. This study concluded that commercial banks have experience and confidence for dealing with agricultural sector and for decrease disparity over time.

Mundal and Dhara (2012) examined relationship between dependent and independent variable. Secondary data have been taken from census of India. For per unit of productivity seventeen crops were selected and composite index have been used. Z score divided agriculture productivity in four category very high (above $+1.000$) score, high ($+0.000$ to $+1.000$), medium (0.000 to -1.000), low (below -1.000). Composite index shows there are much disparity in level of development. Z-score values of developmental showed that the development is high in the southern blocks in comparison to northern and eastern blocks of the district. This study suggested that for sustainable agrarian development, modern technology of agriculture should have to be adopted.

Maan and Singh (2013) examined role of NABARAD in agriculture. Share of agricultural credit share was 0.9 percent in 1951-52 and 28 percent in 1981-82. The share of nationalisation of banks has been increasing. During 1995 and 2005, the share of agricultural credit with urban and metropolitan bank in India increased with 16.3 percent to 30.7 percent.

Khan et. al. (2013) examined in agriculture development. For analysed development of agriculture composite index have been used with eight indicators. This study selected thirteen variables. Composite index divided, block in three categories. High category score (above $+0.21$), medium category score ($+0.21$ to -0.21) and low below (-0.21). This study found higher development in upper central part because farmer of this part have better irrigation facilities and high cropping intensity. Medium level found in lower central part. During the period 1981 to 1991, Raipur block was under in medium score but in 2001 it came in low score because non agriculture have take place. Chakrata block shows low level in all blocks.

Kumar and Jain (2013) studied inter-state variation in agriculture growth in India. Data were taken from ministry of agriculture for the year 1991-99 to 2007-08. For analysed growth and output percent share and CAGR (Compound Annual Growth Rate) used. gini coefficients have been used for relationship between growth and inequality. This study found low

productivity where low rainfall and low irrigation. Rainfall and fertilizer have significant and positive effect with productivity. Inequality in growth of agriculture has increased. During the period 2000 the part under low category did not higher change but which part under high category increased 35 percent.

Godara and Singh (2014) examined agriculture credit in India. Analysis credit delivery to the agriculture sector was not insufficient. Paper showed that the banking system is on different grounds to gives credit to small and marginal farmers. Transformation and admittance to bank credit throughout the post-bank nationalization period have been not sufficient. This study found the policymakers are convinced on microfinance.

Mukhopadhyay (2014) examined convergence food grains production in India. This study has taken 15 states of food grain production during the period 1991 to 2011. This study was used panel unit root tests, sigma convergence and beta convergence. For analysis sigma convergence three measures S.D and C.V were used. This study showed coefficient variation is significant and positive. This study found in case of food grains production show significant sigma convergence. Based on panel data, significant presence of convergence in production of food grains crops. For panel least square showed that negative but statistically significant relationship between growth in per capita food grains production and the initial level. The agricultural weak state in case of food grains production growing a rapid rate comparison to rich state. This study found beta convergence with the first differenced GMM following dynamic panel which showed significant and positive coefficient in term per capita food grain production.

2.2.3) Studies in Regional Context

Dhaka and Verma (1989) examined growth of area, production and productivity of cereals, pulses and oilseeds group of crops and for some of the important individual crops viz. bajra, guar, wheat, gram and rapeseed and mustard in the state of Rajasthan. This study covered the period 1956 to 1988 with two sub periods 1956 to 1966 and 1966 to 1988. The technique of exponential function was employed for computation of growth rates. The study was carried out over the entire state and two most productive agro-climatic zones viz. I irrigated north western plain and III semi-arid eastern plain. The results revealed that the productivity in all the three groups of crops viz. food grains, pulses and oilseeds was negative during pre-green revolution and entire period of study in the state. This showed that modern technology of high yielding varieties had helped in accelerating the rate of growth in production and productivity of these crop groups. Study on individual crops revealed that growth in production of bajra had declined while that of wheat and rapeseed & mustard had significantly increased. Gram recorded positive and on the contrary guar showed negative growth in their production in the state and zone III (a), causing decline in output during post-green revolution period.

Singh and Singh (1991) in their study pertaining to the changes in cropping pattern and production pattern in Haryana agriculture between 1966-67 to 1988-89 based on secondary data revealed that the area under rice and wheat has been increasing by the rate of 9.29 percent & 6.34 percent respective time period. The area under food grains like jowar, bajra, maize, barley and the area under important pulses crops was increasing with 11.60 percent during the study period. The total production of jowar, maize, barley, gram and the other pulses crops has been declining.

Ali and Singh (1995) examined variability in area, production and productivity in wheat crop of Chhattisgarh as well as the state of Madhya Pradesh. Time series data has been used to analyze it from 1970-71 to 1989-90. The study revealed more variability in area, production and productivity of wheat. This study computed coefficient of variation for all the districts, regions and the state as a whole in respect of area, production and productivity. It ranged with 19.23 percent in district of Billoaspur to 40.40 percent in Rajnandgaon district. The highest coefficient of variation (36.51 percent) was observed in the district of Rajnandgon. The significant growth rates were mostly due to improvement in productivity levels.

Narain et. al. (2001) analysed yield rate of crops in Uttar Pradesh where two crops rice and wheat selected. This study analysed variations during 1985-86 to 1989-90 and 1990-91 to 1994-95. This study found variation between two periods more significant in both crops rice and wheat. Mean of this period is very high both crops are significant means there is variations in climate conditions. This studied in different tehsils of rice, wheat and combined rice-wheat. Composite index were used for this analysis. The score of composite index varied from 0.13 to 0.96 for crop rice and 0.16 to 0.99 for crop wheat. The variation in the composite index of rice and wheat combined productivity is 0.23 to 0.99.

This study found increased 18 percent productivity in rice and 10.5 percent productivity in wheat. The productivity levels of each of rice and wheat crops are separately having very high comparison with the combined productivity of rice-wheat. There are many disparities and variations in the rice and wheat productivity are found in different tehsils. Western and hilly areas are found to be better developed in rice and wheat productivity in comparison to other regions of the State.

Rawal (2004) analysed the siri system of labour hiring as it is practised in western region of Haryana. Primary data were collected from Birdhana, a village in Fatehabad district. The case study of Birdhana district suggests that two features of agrarian economy Birdhana - large

size holding's and availability of labour displacing technology. The design of siri contract ensured that the siri households provided as much family labour as possible and mobilized cheap hired labour.

Chaudhary and Madan (2006) examined the regional disparities in development and income from agriculture associated with the variations in Haryana. The observed variations in production and income are the direct outcome of growth of necessary infrastructure and input supply agriculture like irrigation, mechanisation, fertilizer, credit marketing etc. Region having more area under rice; wheat and sugarcane had more income from agriculture than the region where low income crops like bajra, guar, pulses, and oilseeds are predominant.

Mohanty (2009) examined regional disparity in agriculture development in Maharashtra. Secondary data have been taken from season and crop report of Maharashtra and planning commission Government of India. This study concluded that the development of agriculture in Maharashtra over the last three decades indicated regional inequality in which western Maharashtra remained much ahead of other regions in the term of major development indicators. However, compared to Vidarbha the Maratha Wada region experienced better improvement in some respects. The rapid development in western Maharashtra was assigned to the rise of the Maratha kunabi peasants as a unified political class who dominated states politics through caste and kinship network during the colonial periods. The modernization of agriculture in the region was also in the interest of the industrial bourgeois because it created a nearby market for modern agricultural appliances' and opportunities for the establishment of agro-processing industries.

Reddy and Sivashankarmma (2010) examined trends in agricultural productivity and analysed the relative association of agricultural productivity with selected independent variable for the period 1978-79 to 1997-98. This study was based on both primary and secondary data. Data were collected by field survey and from handbook of statistics

department of Andhra Pradesh. This study found positive and significant trend in Chittoor district in Andhra Pradesh. In agricultural productivity, a linear growth rate was of 9.18 percent was recorded during the study period. This study suggested improved the agricultural productivity by increasing actual annual rainfall, worker area ratio, land concentration ratio and worker area ratio.

Reddy and Reddy (2010) examined growth and instability in irrigated area under different surface sources of irrigation. For fulfilled the objectives of study, this study used simple average and percentage method. This study also used log linear model for estimate the relationship between total surface sources of irrigation and the canal, tank, other surface sources of irrigation. This paper observed that the three variables surface sources, ground water sources and other sources of irrigation.

Ardesna and Khunt (2011) examined the gap between actual use and recommended dose of fertilizer and to identify the factors determining the fertilizer used in major crops grown in Gujarat. The study revealed that the gap in respect of use of nitrogenous as observed in all the selected crops but in case of phosphatic, the gap was observed only in bajra crop. The magnitude of gap was higher generally in large farmers. Use of potassic was found more than recommended does in all the crops. In Kharif crops like groundnut and bajra, rainfall has great impact in determination of level of fertilizer use, whereas in crops like cotton and wheat, irrigated area, per farm gross income, lagged prices and cropping intensity where the major factors which determine level of use of fertilizer in this crops. Among the all the modern input, fertilizers played a vital role in modern agriculture. It universally accepted as an integral part of package of practice for rising Indian agriculture to a higher technological plank. The problems become more acute after green revolution because of winding gap between recommended dose of fertilizers and actual use of farmers. Unless addition of plant nutrients which have been removed from these soils in the past is made. Plant nutrients are

essential not only for increasing production but also for maintaining fertility of the soils at desired level. The factors determining the use of fertilizer need to be critically analysed to narrow gap in nutrients supply capacity of soil and nutrient requirement of the plant for sustainable productivity of the crops.

Ajagekar and Masal (2012) examined the regional disparities in the level of agriculture development in Kolhapur district and the disparities in Bhudargad tehsil at micro level. For determine the level of agricultural development in Kolhapur district 14 indicators have been selected. They have been assigned different weights to different indicators by the method of proportional standardized mean and calculated composite index. The districts are grouped in four categories first group of agricultural development cover 15.61 percent areas of the district. This zones covers two tehsils namely Hatkangale, Shirol whose composite index is 20 points above the district average. The second zone is fairly developed. It consists of three tehsils namely Godhinglaj, Karveer and Kagal covering 23.65 percent area of the district. This zone possesses the composite index higher than the district average but less than 20 points. Third zone is poorly developed. This covers almost half of the district total area. Fourth zone is very poorly developed.

Das and Mili (2012) studied the pattern of crop diversification and disparities in agriculture in Assam during the period between 1999-2000 and 2009-10. This paper used Gibb's Martien index of crops diversification. Disparities in agriculture analysed by two varieties (a) proportion of net area sown and (b) cropping intensity. This paper found cultivation of food-grain and the largest share of crop hectare was occupied by tea. This paper concluded that the environmental constraints and natural resources localized in few areas and technological input, infrastructure and facilities was very low and not equally distributed in all the areas.

Kumar et. al. (2012) examined disparities in agriculture development of Haryana, and also explained that how regional disparities have behaved under market forces after liberalisation of Indian economy. This paper used composite development index to measure the extent of regional disparities in agriculture development of Haryana for the year 1990-92, 2000-02 and 2007-09. This paper found inter-district regional disparities between districts of northern and southern Haryana. This study found two factors green revolution and irrigation facilities are responsible for disparities in agriculture development. Intensity of irrigation facility in north is high. This paper showed that in Haryana regional disparities in agriculture development have convergence from 1990-92 to 2000-02, but after this convergence in 2007-09 divergence has started again. This paper suggested special problem oriented planning should be initiated to expand development to all the horizons. Expansion of irrigation facilities to southern and backward districts is most important in them.

Pawar and Jadhav (2012) examined regional disparity in agricultural development in Satara district of Maharashtra. In this paper agricultural disparity has been analysed at tehsil level. This study was based on secondary data and it was taken from district census 2001 and annual report of irrigation department 2010. It is found that due to physiographic, climatic, soil and ground water level are agriculture disparity induced factors. From the foregoing study it is inferred that tehsils Khandala, Javali, Mahableshwar, Patan, Khatav, and Men are underdeveloped whereas Phaltan, Koregaon and Wail are partly developed or developing tehsils. It is suggested that improved irrigation facilities should be practiced for sustainable regional development of agriculture in the agriculturally underdeveloped region of the district. For the sustainable regional development in Satara district there is need of watershed development programme and introduction of new method of irrigation.

Muthumurugan and Elumalai (2012) examined inter-regional variation in agriculture development of Tamilnadu. Data have been taken from State planning commission

Tamilnadu census report and Statistical handbook. This paper have selected 16 indicators for determine the level of agriculture development for the year 1998-99 to 2008-09. This paper used composite index of development for different district. They found wide disparity in among the region of Tamilnadu. Erode has a topper rank in respect of selected variables because the district have more irrigation facilities. This paper found Nilgris has last rank in selected variable because the district is hilly and covered by forest. The land of this district has not able to produce food and other crops. This study suggested Government have to concentration on backward district for make appropriate plan to reduce the agricultural variation in Tamilnadu.

Ramphal (2012) examined performance and suitability of growing crops in Haryana. This study used three measures location quotient, crops versatility index and district versatility index. The specialization of wheat in Panipat, Hisar and Faridabad districts, rice in kurukshatra, kaithal and karnal districts and Faridabad in highest during the period of study.

Patil (2013) examined disparities in levels of agricultural development in Dhule and Nandurbar Districts. In this study included different indicators for analysed of agricultural development with the help of composite index. This study suggested that in Haryana the major policy should be enhancing irrigation facilities in southern region. Fixation of higher procurement prices of oilseeds and pulses and proper arrangements for of the produce of these crops should be given top priority.

Shafiqullah (2013) analysed variations in the levels of agricultural development and casual relationship between dependent variable and independent variables among the districts of the state of Uttar Pradesh. This study has been selected 14 indicators.

This study suggested that districts having low level of regional development should be given top priority.

Shimar (2014) examined growth and instability in agriculture production in Haryana. This study based on second data with 12 major districts. Coefficient of variation is also used to measure the instability in time series data. This paper showed that the instability is low in crop wheat in all the districts. The instability in production of rice is decreasing with karnal, Kurushatra, Ambala, Jind, Hisar, Sirsa and Faridabad districts throughout the study period.

Singh et. al. (2014) examined disparities in agriculture development in Rajasthan. This study covered the time period 1990-2010 with thirty district of Rajasthan. This study was calculated by mean and standard deviation and time period divided in five year for the productivity of agriculture. District have been divided in three category high category those score above (mean + variance), and moderate which score between (mean + variance) whereas low below (mean + variance). They shows deserts districts are low productive comparative non deserts districts. This study concluded productivity increased during the period due to technology. During the period of 1995-2000 numbers of low productive district were increased and all low productive district under desert areas. This study suggested government should focus on this district because higher difference between desert and non desert areas.

Comparative Table

Global level studies		
Authors	Methods	Major findings
Mrutyunjay and Das (2009)	Composite Agricultural Development Index and Regression Analysis	This study found there is need to increase irrigation facility.
Xin and Qin (2009)	TFP growth	The convergence found that the instruments of various regions are dissimilar. Per worker contribution of workers have convergence effect on agricultural labour productivity.
Gorman and Pandey (2010)	TFP growth	This Study founded that disparities in fertilizer, chemical and land per worker. This paper showed correlation in agriculture input and agriculture productivity significantly.
Motebennur (2012)	Kendall's Ranking Coefficient Method	This study found high agricultural productivity in Navalagund and Hubli talukas due to the irrigation facility extended by Mulaprabha river project, black cotton soil use of HYV seeds, fertilizers, pesticides and the use of modern farm technology
Burja (2011)	Factor Analysis Model	Study found conclusive effect on the evolution of the indicators
Indian level studies		
Dev (1987)	Standard Deviation & Coefficient of Variation	This study found the debate on instability in food grain production; it is decreasing from 11.41 percent for 1960-61 to 1969-70 to 11.16 percent for 1970-71 to 1979-80.
Nagraj (1987)	Regression and Correlation Analysis	This study suggested that irrigation is uniformly a dominant influence - especially groundwater.

Dev (1988)	Coefficient of Variation and Decomposition of labour productivity	This study analysed variability in the productivity of labour shows that in the early 1960s, the contribution of land-man ratio to the variability in labour productivity was higher than that of land productivity
Ghosh(2012)	Convergence	This paper suggested the less developed states could upgrade their relative economic position with investments in physical.
Kumar and Jain(2013)	Compound Annual Growth Rate	This study found low productivity where low rainfall and low irrigation. Rainfall and fertilizer have significant and positive effect with productivity. Inequality in growth of agriculture has increased
Godara and Singh(2014)	Percentage Share	The analysis states level analysis that the credit in agriculture sector not insufficient.
Mundlak et. al. (1997)	Production Technology	This study found the importance of capital in agriculture production.
Bhalla and Singh (1997)	Percentage Share	This study found significant changes in growth of agricultural production.
Haque (2003)	Percentage Share	This study suggested small farmers should benefit from the modern technology.
Chand & Kumar (2004)	Percentage Share	This study found the impact of agricultural subsidies on private investments is also positive.
Narayanmurthy (2007)	Coefficient of Variation & Percentage Share	The cost of cultivation increased substantially in all the major crops.
Bhalla and Singh (2009)	Percentage Share	Punjab is famous for rice, major producer of wheat, Andhra Pradesh is famous for Tobacco and cotton, Bihar is famous for paddy crops.
Hasmi and Iqbal (2010)	Percentage Share	This study analysed variation in the number of tractor use and in cropping

		intensity has positive impact
Kumar and Inderjeet (2010)	Coefficient of Variation & Percentage Share	There is need to formulate policies for the improvement of yield of different crops
Panda (2010)	Compound Average Growth Rate and Gini Coefficient	This study suggested there is need for stepping up direct credit to farmers by the institutional agencies.
Asayehengn (2012)	Descriptive Statistics	This paper found the of mean irrigation consumer to non consumer exceed with 37.03 percent.
Maan & Kumar (2012)	Growth Rate and Gini Coefficient	This study found inequality in distribution of loans to distribution of fertilizers had decreased.
Mundal and Dhara (2012)	Composite Development Index	This study suggested that for sustainable development, modern technology of agriculture should have to be adopted.
Maan and Singh (2013)	Percentage Share	The percentage share in agriculture credit increased from 7.3 to 19 percent during 1995 to 2005.
Kumar and Sharma (2013)	Regression Models	This study found food grain crops, non-food grains crops produced per unit of land.
Kumar & Jain (2013)	Compound Annual Growth Rate	This study found inequality in growth of agriculture has increased
Khan et. al. (2013)	Composite index	This study found higher development in upper central part because farmer of this part have better irrigation facilities and high cropping intensity
Mukhopadhyay (2014)	Sigma & Beta Convergence	Food grains production show significant sigma convergence.
Regional Studies		
Narain et. al. (2001)	Composite Index	Found increased 18 percent productivity in rice and 10.5 percent productivity in wheat
Rawal (2004)	Percentage Share	In this study siri households provided as much family labour as possible and mobilized cheap hired labour.
Chaudhary and Madan (2006)	Percentage Share	This study found difference between agriculture and income is varied in difference region

Mohanty (2009)	Composite Index	This study found better situations of the Marathwada area.
Reddy & Sivashankarmma (2010)	Co-efficient of Variation	This study found positive and significant trend in Chittoor district in Andhra Pradesh
Reddy and Reddy (2010)	Simple Average and Percentage Method	This study shows the relationship between total surface sources of irrigation and the canal, tank, other surface sources of irrigation.
Ardeshta and Khunt (2011)	Percentage Method	Plant nutrients are essential not only for increasing production but also for maintaining fertility.
Ajagekar and Masal (2012)	Composite Index	This study analysed regional disparities in the agriculture development
Das and Mili (2012)	Co-efficient of Variation	Agriculture production and modern technologies in agriculture should be increased.
Kumar et.al. (2012)	Composite Development Index	Found two factors green revolution and irrigation facilities are responsible for disparities
Raman and Kumari (2012)	Composite Development Index	Long term policy should be introduced by government.
Pawar and Jadhav (2012)	Composite Development Index	Suggested that improved irrigation facilities.

2.3) Research Gap

There are literature related the agricultural growth, like cropping pattern and disparities in agriculture in India. Several studies such as Mehra (1981), Hazell (1982), Rao et al(1988) etc. have pointed out that the new strategy of agricultural production based on HYV seed fertilizer technology has contributed to the growth in production and productivity in India. Bhalla and Singh (2001) showed that a marked acceleration took place in both the output and yield growth rate in Indian agriculture during 1980-83 to 1992-95. Ghosh (2006) analysed the l disparities in agricultural development in India during 1960-61 to 2001-02. Many studies such as those by

Evans and Karras (1996), Sala-i-Martin (1996), and Evans (1997) found beta convergence in per capita log income among the states of the U.S.A. On the other hand, Somasekharan et al. (2011) measured the convergence hypothesis in per capita agricultural output and food grains productivity India. Previous studies were based on global and Indian level studies. This study is based on special Haryana district-wise and zone wise.

CHAPTER-3
**RESEARCH
METHODOLOGY**

CHAPTER - 3

RESEARCH METHODOLOGY

Research methodology is an important part of the research and it is used to know what the methods are used for the analysis the study. The following research methodology is adopted to fulfil the objectives of the study.

3.1) Collection of Data

This study is based on secondary data, which were collected from the published reports and Department of Economics and Statistical Analysis, Government of Haryana. The study has been conducted district -wise and zone -wise analysis for the period 2001-02 to 2014-15, pertaining to areas, production and productivity of selected major food grain and cash crops.

3.2) Research Methods

For measure growth rate different methods are used such as exponential growth rate, kinked exponential growth, CAGR (Compound Annual Growth Rate). This study used CAGR by zone -wise and district-wise disparities of area, production and productivity of major selected crops in Haryana. Haryana divided four zones, northern, central, and western zone. Northern zone included Ambala, Panchkula, Yamunanagr, Kurukshetra, Karnal and Panipat. This zone is endowed with more assured irrigation and fertile soil. Central zone included 5 districts, namely Kaithal, Sonipat, Rohtak, Jhajjar, and Jind. This zone is more or less like zone as far as range of temperature during summer as well as during winter is concerned, but there is a slight difference in soil texture and annual average rainfall. Western zone included 5 districts namely Bhiwani, Fatehabad, Sirsa and Hisar. This zone is arid and dry. Southern zone included 6 districts namely Faridabad, Mahendergarh, Rewari, Gurgaon, Mewat and Palwal. Although the general agro-climatic outlook except rainfall in zone -IV are more or less similar to that of zone-III.

σ -convergence model has been used for significance of standard deviations of area, production and productivity over time and β convergence model has been used to find the significance of these growth rates by regression on their initial values. These models deal the total production as a sum of major selected crops. Productivity is calculated by the formula (production/ area)*100 in this study.

3.3) CAGR (Compound Annual Growth Rate)

To fulfil the objectives the Compound Average Growth Rate for areas, production and productivity during the period 2001-02 to 2014-15 (CAGR) has been used which states change in variable year over year.

Compound Growth Rate: $Y_t = Y_0(1 + r)^t$

Here Y_t and Y_0 are the areas, production and productivity for terminal and initial period of a particular state. r is the compound growth rate.

3.4) Co-efficient of Variations

Co-efficient of Variations is the ratio of the standard deviation to the mean. The higher the coefficient of variation, the greater level of dispersion around the mean.

$$C.V = \text{Standard Deviation}/\text{Mean}$$

$$\text{Standard Deviation} = \left[\sum (x_i - \bar{x})^2 / N \right]^{1/2}$$

Where, N =Total Number of Observation

X_i =Area/Production or Productivity

$\bar{X}$ =Mean of the Distribution

3.5) Convergence Model

On the basis of neoclassical growth models, countries with lower GDP per capita will indicate to grow faster than richer ones. However, convergence is not always confirmed. This

means that economies are converging but the steady-state level is not always common, so countries may converge to own level of steady-states. At the same time, the word ‘convergence’ can be explained by different ways.

According to Barrow Sala-i-Martin there are three concepts of convergence, σ -convergence, β -convergence and conditional convergence. But this study used two convergences; σ -convergence and β -convergence. Absolute convergence hypothesis following considers: group of all members of countries which have access to the same technology the same population growth and the same propensity to save and on different in term of their initial capital labour ratio. Then we should expect all countries to converge to the same steady capital- labour ratio, output per capita and consumption per capita and consumption per capita and of course, the same growth.

3.5.1) σ -Convergence

While β -convergence emphasis on determine possible catching-up processes, σ -convergence simply refers to a diminishing of disparities among regions in time. The two concepts are of course closely related. Formally, β -convergence is necessary but not adequate for σ -convergence. Instinctually, this is either because economies can converge towards one another but random shocks push them apart or because, in the case of conditional β -convergence, economies can converge towards different steady-states.

This study deals with σ -convergence of dispersion of area, production and productivity across the districts over time. This model is based on calculating the standard deviation (S.D) across four zone and nineteen districts of Haryana for each year starting from 2001-02 to 2014-15. As the σ -convergence measures the inter-regional inequality, it may very well infer that the inter-regional inequality among the districts have increased during given time period. When the dispersion of area, production and productivity across districts falls over time, there is σ -convergence. The model is

$$SD_t = \eta + \tau t + \omega_t$$

There, SD = Standard Deviation (Area, Production and Productivity)

η = Intercept, τ = Slope coefficient, ω = Error term, t = time (2001-02 to 2014-2015)

3.5.2) β -convergence

β -convergence concerns a process in which poor regions grow faster than rich ones and therefore catch up on them. The concept β -convergence is directly related to neo-classical growth theory (Solow, 1956) where one key assumption is that factors of production, in particular capital, are subject to diminishing return. Accordingly, the growth process should conduct economies to a long-run steady-state characterised by a rate of growth which depends only on the (exogenous) rates of technological progress and labour force growth. Diminishing return also implies that the growth rate of poor economies should be higher and their income and per head levels should catch up with those of rich economies. When all economies are assumed to converge towards the same steady-state (in terms of GDP per head and growth rate), β -convergence is also called absolute convergence. However, the steady-state may depend on features specific to each economy, in which case convergence will still take place, but not necessarily at the same long-run levels. This will be the case when GDP per head is supposed to depend on a series of determinants such as factor endowment or institutions, which can vary from one economy to the other even in the long-run. Beta-convergence is then said to be conditional.

β -convergence is empirically examined by estimating regression of the annual growth rate of production and productivity on the initial level of production and productivity. Hence, the test for the absolute β -convergence hypothesis is performed by estimating the following equation by the ordinary least squares (OLS) method.

$$G.W_i = \alpha + \beta X_0 + \mu_i$$

Here, G.W. = Growth rate (2001 to 2015), Production (000 tonnes) and Productivity (kg/ha)

α = Intercept, β = Slope Coefficient, μ_i = Disturbance term,

X_0 = Initial area, production and productivity, i = Districts

Partial correlation between growth of area, production and productivity over time and its initial level is negative, there is β -convergence.

3.6) Regression Analysis

To identify the inputs contributing significantly in agricultural production based on selected crops, for all the districts under study, over the period 2001-02 to 2014-15 at first stage simple regression analysis was carried out for each district by taking total production as dependent variable and inputs as independent variable. Using the following model:

3.6.1) Multiple Regression Model

It shows relationship the between a dependent variable and two or more independent variables. To assess the influence of agriculture input on agriculture production, the multiple linear regression analysis by Ordinary Least Square (OLS) estimation has been applied by Eviews Software. The functional form of multiple linear regression models is given below:

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \mu_i$$

Where,

Y_i = Dependent Variable- Agriculture production of selected food grain crops

α = is the constant or intercept

($X_1, \dots, X_5$) are Independent Variables

X_1 = Irrigation

The irrigation is the most important factor for agriculture in the Haryana district, for increase productivity .Irrigation facility can help in solving the problems created insufficient, uncertain and irregular rains

X_2 = Fertilizer

The proper use of chemical fertilizers can considerably increase the productivity of soil. Increase agricultural production is related to increased consumption of fertilizers.

X_3 = Pesticides

Pesticide is a chemical preparation for destroying plant, fungal, or animal pests.

X_4 = Rainfall

The food grain production of India has a proportional relationship to the monsoon, with its critical dependence on the onset, duration and distribution of rainfall. In this study we measured rainfall in centimetre.

X_5 = Tractors

Agricultural machines increase productivity of land and labour by meeting timeliness of farm operations and increase work out-put per unit time

$(\beta_1, \dots, \beta_5)$ = the slope (beta coefficient) for $(X_1, \dots, X_5)$

μ_i = Random Error or Stochastic Disturbance Term

After regression this study checks multicollinearity.

3.7) Multicollinearity

The term Multicollinearity is introduced by 'Ranger Frish'. Multicollinearity is a high degree of correlation among all explanatory variables.

Problem Multicollinearity: If independent variables contain essentially same information to a large extent, one gains little by using both the regression model. Multicollinearity leads to unstable estimates as it tends to increase the variances of regression coefficients.

Symptoms of multicollinearity may observe in situations:

1. R- Square for regression is very high
2. Coefficient may have very high standard error

High degree of correlation coefficient do not necessary implies Multicollinearity. Than can make a judgement by checking Tolerance and VIF (Variance Inflation Factor). The i th tolerance value is defined as $(1-R^2_K)$, R^2_K is the coefficient of determination for the i th independent variable on all the other independent variables. VIF is the reciprocal of a tolerance value. VIF is a measure of the effect of multicollinearity on the variance parameter estimates. High VIF suggest the presence of multicollinearity.

- $VIF > 10$ indicate presence of multicollinearity

If VIF value is lowest 10 then there is not multicollinearity

CHAPTER-4

**REGIONAL DISPARITIES
IN AGRICULTURAL
DETERMINANTS IN
HARYANA**

CHAPTER - 4

REGIONAL DISPARITIES IN AGRICULTURAL DETERMINANTS IN HARYANA

4.1 Introduction

Agricultural determinants are the most important for agricultural growth. This chapter is an attempt to analyse the regional disparities (district-wise and zone-wise) in context of agricultural determinants in Haryana. Agriculture determinants are refers as such variables which influence the agriculture production. There are various determinants of agriculture production in this study irrigation, HYV seeds, use of chemical fertilizers, pesticides, rainfall and agricultural credit. This chapter divided in to 2 sections. The first section attempts the trend and pattern of agricultural determinants in state. The second section depicts the behaviour determinants zone-wise and district-wise and shows the regional variations among the districts and zone inform of coefficient of variation.

4.2) Disparities in Agriculture Production and Agricultural Inputs in Haryana Zone-wise

Irrigations

The irrigation is the most important factor for agriculture productivity. The period of rainfall in Haryana is June to September. In some parts of the Haryana it is low. In the lack of irrigation, the farmer cannot risk his investment in other inputs that contribute to increased productivity. It is important, because there are some crops that require a large quantity of water and some crops require water for a long period. For example, rice cannot be growth if the availability of water is less; sugarcane requires water not only in loose quantities but also for a long period. Thus, irrigation becomes necessary of certain crops. Irrigation facility can help in solving the problems created insufficient, uncertain and irregular rains. However, the irrigation is highly unequal in India, it has much importance in agriculture sector and it has to provide where it is possible by the govt. to reduce the widening disparities in agriculture.

Table 4.1 Percentage of net area under irrigation in Haryana	
2001-02	83.90
2002-03	82.40
2003-04	88.00
2004-05	84.00
2005-06	82.30
2006-07	82.30
2007-08	84.10
2008-09	82.00
2009-10	86.40
2010-11	82.10
2011-12	84.00
2012-13	88.30
2013-14	83.30
2014-15	84.50
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)	

The table 4.1 shows percentage of net area under irrigated in Haryana. There are not much disparities in Crop area irrigated during the period 2001 to 2015; it is above 80 percentages over the period.

4.2.2) Sources of Irrigations

Irrigation is one of the important agricultural inputs. The table 4.2.1 shows the area under different sources of irrigation like canals, Tube wells and others etc in Haryana zone-wise. Others sources includes tanks, wells etc.

An irrigated area in Haryana by canal irrigation of northern zone was continuously declined but it was highest in 2009-10 with 11.54 percent; whereas in central zone it was increased. Trend of canal irrigation in western and southern zone was declined during the period. Highest irrigation by canal in western zone and lowest in southern zone. Except western zone

there is declined irrigation by tube well in other three zones over the period. Highest trend share in northern and lowest in western zone. Trend of other sources irrigation decreasing in western and southern zone. Out of total area irrigation by tube-wells irrigated maximum comparison in canal and other sources irrigation.

CAGR in canal irrigated was negative in western zone with -0.98. It was highest positive in northern zone, but percentage share is increased. Growth rate of tube- wells negative with -3.14 percent in western zone whereas highest positive in central zone of Haryana. CAGR in other source highest positive in western with 3.49 and negative in northern and central zone with -6.08 and -6.00 percent respectively.

C.V. shows the variations in sources of irrigation zone wise. In canal irrigations highest variation in northern zone and lowest in southern zone with 15.11 and 2.17 percent coefficient of variations. There are not much disparities in central and western zone.

In case of tube-well highest variations in western zone with 21.81 percent coefficient of variations whereas lowest in northern zone with 4.21. There are not much disparities in central and southern zone. In other not much disparities in all zones of Haryana.

Table 4.2.1 Percentage share of sources of irrigations in Haryana zone-wise (2001-02 to 2014-15)																	
Irrigations	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Canal	Northern	10.25	08.94	08.30	06.81	07.57	10.59	11.31	10.07	11.54	09.75	08.01	07.01	07.93	06.10	3.77	15.11
	Central	28.64	35.33	33.01	35.03	33.73	34.53	34.91	34.72	34.30	34.95	33.25	34.91	33.25	32.89	-0.98	7.07
	Western	57.79	52.50	55.69	55.23	55.75	52.13	51.03	53.76	52.12	52.81	54.94	51.03	54.94	52.56	0.68	7.55
	Southern	03.32	03.24	03.00	02.94	02.95	02.76	02.75	01.46	02.04	02.50	03.80	02.90	03.80	02.98	0.77	2.17
Tube wells	Northern	35.38	36.62	36.44	37.92	36.78	33.38	31.07	32.52	33.06	31.35	34.48	31.07	32.34	30.30	1.11	4.21
	Central	24.20	20.91	19.10	20.69	19.81	20.55	19.26	19.02	22.25	20.70	23.33	19.26	18.90	18.70	1.86	9.55
	Western	14.66	16.71	18.01	17.10	17.16	22.50	24.42	21.96	15.94	21.54	22.48	24.42	23.83	22.90	-3.14	21.81
	Southern	25.77	25.77	26.44	24.28	26.24	23.57	25.25	26.50	28.75	26.42	19.70	25.25	23.78	23.90	0.54	10.45
Others	Northern	10.34	07.69	04.00	04.35	13.04	14.29	10.00	17.65	25.00	20.00	25.00	24.80	25.90	24.89	-6.08	3.21
	Central	13.79	46.15	44.00	47.83	47.83	52.38	60.00	64.71	25.00	40.00	35.00	32.78	32.89	32.80	-6.00	2.08
	Western	41.38	15.38	28.00	21.74	21.74	14.29	15.00	11.76	37.50	20.00	25.00	25.90	25.67	25.60	3.49	2.18
	Southern	34.48	30.77	24.00	26.09	17.39	19.05	15.00	05.88	12.50	20.00	24.00	23.56	23.89	23.78	2.69	3.56
Source : Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)\																	

The table 4.2.2 shows total area irrigated in Haryana crop wise percent share. Highest irrigation of crop rice in southern zone. Trend of irrigation under crop rice was increased in northern, central and western zone decreased in southern zone. Total irrigated area of wheat was highest in southern zone. Except southern zone trend share was increased during the period. Central zone have recorded highest percent share of irrigation for crop jowar in southern zone. Trend of irrigation under crop jowar increasing in northern and western zone and decreasing in central and southern zone. Trend irrigation share under bajra increased in all three zones except northern zone.

Trend irrigation share under maize was increased in northern, western and southern zone. There are no much disparities in central zone. Trend share under gram was decreased in all zones. Trend share under irrigation crop sugarcane and total cotton was decreased. Total pulses crop have highest irrigation in northern zone. Trend share under this crop was decreased in all zones of Haryana. CAGR under rice was positive with 5.48 percent in southern zone, whereas negative in other three zone. CAGR under wheat positive in southern zone with 5.78 percent whereas it is negative in all other three zones. CAGR of irrigation under jowar was negative in northern and southern zone, whereas it is positive in central and southern zones. CAGR under crops bajra positive in northern and negative in other three zones. CAGR of total cereal positive in southern zone with 1.79 percent whereas negative in northern, central and western zones. CAGR under crop maize negative in northern, western and southern zone but in central zone zero growth rate was recorded. CAGR of gram positive in all zones. Highest positive in northern with 6.76 percent and lowest in southern with 1.61 percent. Growth rate of sugarcane higher in western and lowest in central zone.

Table 4.2.2 Percentage share of total area irrigated in Haryana (Crop wise) (2001-02 to 2014-15)																	
Crops	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Rice	Northern	45.44	51.11	48.85	47.41	48.92	47.04	46.88	46.36	41.20	43.98	42.90	42.91	43.15	42.90	0.41	5.96
	Central	37.45	31.78	32.46	33.07	33.07	33.84	33.62	33.58	39.02	34.61	35.24	35.27	35.16	35.24	0.44	13.72
	Western	13.50	12.99	16.50	14.73	14.68	15.49	15.85	16.23	18.69	17.01	17.34	17.39	17.50	17.58	-1.77	18.68
	Southern	03.61	04.12	02.19	04.78	03.33	03.63	03.65	3.82	01.09	0 4.40	04.52	04.43	04.19	04.27	-1.58	31.90
Wheat	Northern	21.51	23.28	22.53	22.60	23.08	23.07	24.27	27.96	22.55	22.23	22.24	22.17	22.21	22.26	-0.24	10.98
	Central	29.69	32.53	30.44	30.15	29.66	30.31	23.48	27.13	29.71	29.60	29.41	29.38	29.35	29.40	0.07	8.57
	Western	32.90	33.92	32.09	32.20	32.80	32.94	35.52	31.79	34.33	34.25	34.53	34.45	34.44	34.38	-0.34	7.00
	Southern	15.90	10.27	14.93	15.05	14.46	13.68	16.73	13.12	13.42	13.93	13.82	14.00	13.99	13.96	1.00	10.52
Jowar	Northern	23.91	32.32	25.96	29.29	22.83	31.63	36.19	37.74	40.20	42.00	42.86	41.84	42.00	42.06	-4.08	22.86
	Central	58.70	51.52	54.81	53.54	56.52	53.06	47.62	47.17	43.14	41.00	39.80	39.80	41.00	39.25	2.81	13.05
	Western	02.17	02.02	3.85	03.03	04.35	03.06	02.86	02.83	04.90	06.00	07.14	07.14	07.00	07.48	-8.15	35.17
	Southern	15.22	14.14	15.38	14.14	16.30	12.24	13.33	12.26	11.76	11.00	10.20	11.22	10.00	11.21	2.90	14.61
Bajra	Northern	02.70	00.75	01.14	01.19	01.16	01.06	01.28	00.79	01.40	0.90	0.99	0.90	01.33	00.90	7.44	31.77
	Central	31.08	33.83	28.57	32.14	31.21	29.63	29.79	30.71	33.18	31.98	37.62	34.39	34.51	34.53	-1.36	19.85
	Western	37.84	39.10	37.14	39.29	35.84	37.04	31.91	33.07	35.98	34.23	38.12	34.39	34.07	33.63	-0.05	12.95
	Southern	28.38	26.32	33.14	27.38	31.79	32.28	37.02	35.43	29.44	32.88	23.27	30.32	30.09	30.94	1.43	24.40
Total cereals	Northern	53.62	53.74	46.42	51.65	51.28	37.94	36.02	34.61	39.96	33.45	43.86	26.93	26.92	36.53	1.45	5.10
	Central	09.52	02.86	03.45	04.35	03.64	03.28	03.45	02.22	04.76	02.74	04.26	32.31	32.25	43.70	5.92	6.33
	Western	109.52	128.57	86.21	117.39	98.18	91.80	80.46	86.67	112.70	97.26	161.70	29.17	29.21	3.95	-2.74	27.11
	Southern	133.33	148.57	112.07	143.48	112.73	114.75	86.21	93.33	122.22	104.11	163.83	11.58	11.62	15.82	-1.46	4.33
Maize	Northern	14.29	14.29	20.00	16.67	14.29	25.00	25.00	20.00	20.00	11.11	20.00	22.22	14.29	25.00	-2.37	36.64
	Central	28.57	28.57	20.00	16.67	14.29	12.50	25.00	20.00	20.00	22.22	20.00	22.22	28.57	25.00	2.58	32.68
	Western	42.86	42.86	40.00	50.00	57.14	50.00	37.50	40.00	20.00	44.44	40.00	33.33	28.57	25.00	0.49	33.22
	Southern	14.29	14.29	20.00	16.67	14.29	12.50	12.50	20.00	40.00	22.22	20.00	22.22	28.57	25.00	-2.37	35.95

Barely	Northern	16.12	18.18	15.62	17.24	10.00	16.12	10.25	11.90	25.53	4.65	7.89	5.26	7.32	6.52	5.24	45.64
	Central	9.67	9.09	6.25	10.34	13.33	12.90	7.69	4.76	2.12	9.30	10.52	10.53	9.76	15.22	-0.60	31.30
	Western	38.71	48.48	53.12	55.17	56.66	54.83	71.79	71.42	61.70	69.76	68.42	71.05	68.29	63.04	-3.99	28.84
	Southern	35.48	24.24	25.00	17.24	20.00	16.12	10.25	11.90	10.63	16.27	13.15	13.16	14.63	15.22	7.34	7.14
Gram	Northern	10.87	13.33	14.71	16.13	13.64	17.24	14.29	11.11	30.00	11.11	15.00	13.04	4.00	17.86	-2.27	56.08
	Central	6.52	6.67	5.88	3.23	4.55	6.90	7.14	2.22	2.50	11.11	15.00	13.04	8.00	10.71	-5.78	40.01
	Western	71.74	66.67	64.71	64.52	68.18	58.62	64.29	75.56	37.50	66.67	55.00	60.87	76.00	64.29	1.92	37.42
	Southern	10.87	13.33	14.71	16.13	13.64	17.24	14.29	11.11	30.00	11.11	15.00	13.04	12.00	7.14	-2.27	55.64
Sugarcane	Northern	62.86	60.13	54.01	57.23	60.61	65.63	65.00	66.91	71.11	53.85	72.62	55.45	54.87	55.65	-1.03	19.52
	Central	25.71	27.22	31.02	30.82	31.06	25.78	26.43	24.46	20.00	33.33	21.43	38.18	39.82	40.00	1.31	17.08
	western	6.43	8.23	10.70	7.55	3.79	3.91	4.29	4.32	3.33	5.13	2.38	1.82	2.65	1.74	7.35	43.15
	Southern	5.00	4.43	4.28	4.40	4.55	4.69	4.29	4.32	5.56	7.69	3.57	4.55	2.65	2.61	2.43	32.42
Total cotton	Northern	1.60	1.09	3.77	2.24	0.80	0.85	1.13	1.23	0.67	0.39	0.40	0.59	0.40	0.40	10.32	83.15
	Central	9.77	5.18	10.55	11.40	11.74	12.29	11.47	11.70	10.47	10.64	11.92	10.74	11.09	11.51	-1.41	11.43
	Western	88.10	46.87	84.56	84.49	83.92	84.13	86.09	86.65	88.64	88.59	87.27	88.48	88.12	87.70	0.07	9.12
	Southern	0.53	46.87	1.13	1.87	3.54	2.73	1.32	0.41	0.22	0.39	0.40	0.20	0.40	0.40	2.00	47.12
Total pulses	Northern	8.06	9.38	8.11	6.45	7.41	6.45	6.90	5.06	8.00	10.00	8.33	8.00	8.33	7.14	-0.23	17.10
	Central	17.74	18.75	31.08	32.26	37.04	35.48	36.21	26.58	42.00	32.50	27.08	42.00	43.75	37.50	-2.98	22.82
	Western	56.45	56.25	44.59	45.16	38.89	38.71	43.10	50.63	34.00	42.50	45.83	34.00	35.42	39.29	1.50	31.20
	Southern	17.74	15.63	16.22	16.13	16.67	19.35	13.79	17.72	16.00	15.00	18.75	16.00	12.50	16.07	-0.39	24.15
Total food- grains	Northern	25.95	25.55	29.90	29.30	29.74	29.53	28.38	27.61	28.05	27.97	27.90	28.05	27.97	27.90	-0.51	2.83
	Central	28.45	31.00	29.16	31.63	31.33	31.62	31.43	30.87	31.51	31.29	31.71	31.51	31.29	31.71	-0.77	7.40
	Western	29.54	28.82	27.97	26.70	26.72	27.03	27.43	28.78	28.71	28.62	28.85	28.71	28.62	28.85	0.17	9.13
	Southern	16.06	14.63	12.97	12.37	12.20	11.81	12.76	12.74	11.73	12.12	11.55	11.73	12.12	11.55	2.38	14.75

Source : Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)

CAGR of total cotton was positive highest in northern and lowest in central zone. Highest positive CAGR in western zone under total pulses. It was followed by southern, northern and central with 5.79, 3.72 and 0.68 percent respectively. CAGR under total food grain was positive in southern zone with 5.63 and negative in northern zone. C.V shows variations in food grains crops. In rice crop highest variation in southern zone with 31.90 percent and lowest in northern zone with 5.96 percent. There are not much disparities in wheat in northern & southern zone. In jowar crop highest variations in western zone with 35.17 percent coefficient of variation. In bajra crop highest variations in northern and lowest in western with 31.77 and 12.95 percent respectively. Highest variations in crop total cereals in western zone with 27.11 percent coefficient of variation. In case of maize crop coefficient of variation is 36.64, 32.64, 32.68 and 35.95 in northern, central, western and southern zone respectively. In crop barely highest variation in northern and lowest in southern zone over the period. Western zone having highest variation in western zone and lowest in central zone in case of crop sugarcane. In case of crop total food grains highest variation in southern zone.

4.2.3) High Yielding Variety Seeds

High yielding variety seeds are important as input in the agriculture sector. The high yielding variety seeds used particularly for food grains. The High Yielding Varieties Programme (HYVP) was Government sponsored programmes directed at the general problems of food grains shortage and rural poverty in India. The programme motive at raising farm productivity and rural earnings. The former resulted in the intensive agricultural district programme which attempted to increase farm productivity in well endowed districts by applying a package of inputs consisting mainly of high quality seeds and chemical fertilizers. Nevertheless, the programme was not so impressive as to solve the food grain shortage in India. The problem was deeply felt during the acute shortage of food grains which India experienced in 1965-66 and 1966-67. Reading the exigency of the time, the Union

Department of Agriculture, in August 1965, made its pronouncement of a 'New Strategy' of agricultural development. HYV improved quantity and quality of crops, which is the best measure of increasing agriculture production. The highly HYV concentrates only important agricultural crops that have to extent to the number of crops cultivated in the agriculture in Haryana.

The table 4.2.3 shows crop wise percentage share of each region of area under HYV seeds. Area under HYV in rice increased in northern, central and southern zones. Trend share of wheat increased in three zones except southern zone of Haryana. Area under HYV under bajra increased in central and southern zones whereas decreased in northern and western zones. CAGR of area under HYV seeds for the crop rice was negative in all zones of Haryana. It is highest negative in southern and lowest in western zone. Growth rate of area under HYV for crop wheat positive in three zones except southern. CAGR of bajra negative in all zones of Haryana. CAGR under maize positive highest in central with 2.82, it was followed by northern, southern and western zones respectively. Percentage share of HYV was lowest in crop maize; it was followed by wheat, rice and bajra. It is highest negative in western and lowest in southern zone. Coefficient of variation is highest in HYV use in crop rice in southern and lowest in northern zone over the period. HYV use in crop wheat highest variation in southern zone and in crop bajra highest variations in northern zone.

Table 4.2.3 Crop –wise percentage share zone –wise of area under HYV seeds (2001-02 to 2014-15)																	
Crops	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Rice	Northern	41.11	48.43	49.00	47.10	47.91	46.24	46.37	48.10	48.87	48.08	47.37	44.63	51.09	52.55	-1.91	17.03
	Central	37.92	35.38	32.00	33.91	34.82	34.78	34.90	36.23	35.64	36.33	39.26	37.80	23.37	20.92	-7.63	27.46
	Western	15.99	12.59	16.83	15.94	14.04	15.29	15.16	12.85	12.63	13.07	12.17	16.46	23.54	23.98	-0.79	12.40
	Southern	4.98	3.60	2.17	3.04	3.24	3.69	3.57	2.82	2.86	2.52	1.19	1.12	2.00	2.55	-8.11	39.81
Wheat	Northern	22.12	25.98	23.28	23.58	23.26	24.23	23.67	23.77	23.75	23.55	22.97	24.19	20.24	23.62	0.39	6.30
	Central	29.46	29.58	30.50	30.18	29.55	31.32	31.60	31.69	30.68	30.41	30.39	31.64	35.39	31.46	0.39	4.10
	Western	31.86	29.97	31.81	31.47	32.71	34.00	34.18	34.03	35.33	35.20	35.06	36.99	37.24	37.82	1.15	7.34
	Southern	16.56	14.47	14.42	14.78	14.48	10.45	10.55	10.52	10.24	10.84	11.59	7.18	7.12	7.10	-5.94	17.29
Bajra	Northern	0.74	0.49	0.27	0.20	0.23	0.23	0.61	0.59	0.76	0.70	0.78	0.78	0.56	0.55	-4.83	33.96
	Central	16.76	15.28	19.13	17.65	17.86	18.16	19.67	19.63	20.08	19.86	18.99	19.09	20.15	18.20	-2.27	14.86
	Western	44.15	44.77	52.80	44.35	43.65	47.20	45.16	44.88	43.75	43.69	40.99	41.15	28.72	27.29	-6.13	22.52
	Southern	38.36	39.47	27.79	37.80	38.25	34.41	34.56	34.91	35.42	35.75	39.23	38.98	50.58	53.96	-0.45	10.68
Source: Department of Economic and Statistical Analysis, Government of Haryana, (2001-2015)																	

4.2.4) Rainfall

In India, rainfall variability is a central driver of the national economy. Although a considerable volume of Himalayan water flows into India, in situ rainfall is the main resource for agriculture which generates about 20 % of the national GDP (CIA 2012). More than half of the country's population depends on agriculture for their livelihoods. Indian climate is dominated by the southwest monsoon accumulating 70 percent to 90 percent of annual precipitation between June and September. The food grain production of India has a proportional relationship to the monsoon, with its critical dependence on the onset, duration and distribution of rainfall.

Table 4.2.4 Rainfall in Haryana zone-wise (in centimetre)				
Years	Northern	Central	Western	Southern
2001-02	453.30	203.50	138.10	182.90
2002-03	391.90	182.20	156.20	118.50
2003-04	486.90	244.70	155.10	272.80
2004-05	449.20	233.10	110.00	166.40
2005-06	410.70	296.80	140.80	184.80
2006-07	292.00	153.80	102.60	148.30
2007-08	359.70	227.40	110.00	277.50
2008-09	477.40	379.60	155.90	338.60
2009-10	376.50	229.00	171.90	253.50
2010-11	583.10	300.30	154.70	399.90
2011-12	468.10	228.90	137.60	317.80
2012-13	359.70	227.40	157.00	260.00
2013-14	476.10	200.80	188.00	241.80
2014-15	468.10	228.90	137.60	317.80
C.V	16.77	23.48	16.72	25.29
Source: Department of Economic and Statistical Analysis, Government of Haryana, 2001-2015				

The table 4.2.4 shows rainfall in Haryana zone wise during 2001-02 to 2014-15. Rainfall was increased in northern zone with 453.0 to 468.1 centimetres during 2001-02 to 2014-15. In central and southern zones, also increased during the period, whereas it was decreased in western zone. Highest variations in rainfall in southern zone with 25.29 percent.

4.2.5) Consumption of chemical fertilizer

The use of chemical fertilizer is most important for the growth of agricultural output. The role of chemical fertilizers for increased agricultural production. India is the second largest consumer of fertilizers in the world after China. It accounted for 15.3 percent of the world's nitrogenous consumption, 19 percent of phosphatic and 14.4 percent of potassic nutrients in 2008 (FAI, 2010). However, after introduction of green revolution in 1966-67, per hectare fertilizer consumption more than doubled in the next five years from about 7 kg in 1966-67 and 16 kg in 1971-72, which further increased and reached a level of 50kg in mid-1980s. Average fertilizer consumption on per hectare basis crossed 100 kg in 2005-06 and reached a record level of 135 kg in 2009-10. However, per hectare fertilizer consumption fell during 1973-74 and 1974-75 due to oil shock of 1973 when oil prices quadrupled almost overnight. The next reversal in intensity of fertilizer use came in 1992-93 when government decontrolled phosphatic and potassic fertilizers and increased fertilizer prices significantly. According to the national commission on agriculture "increasing production of agriculture is related to increased consumption of fertilizers". There are three types of chemical fertilizer are use of in agriculture.

1. Nitrogenous fertilizer which comprises saltpetre, nitre, and urea etc. 2. Phosphatic fertilizer comprises of bonus and rock phosphates. It helps in the root development of crops. 3. Potassic fertilizers comprises of potassium chloride and potassium sulphate. It helps the transference of food materials from one part of plant to another. The proper use of chemical

fertilizers can considerably increase the productivity of soil. Indian soil is deficient in nitrogen and phosphorous and this deficiency can be made good by an increase use of fertilizers. Since, possibilities of extensive cultivation are extremely limited because most of the cultivable area is already being cultivated, there is no option but to extend intensive cultivation in more and more areas by using larger quantities of fertilizers to meet the demand for multiple cropping is possible.

Figure 4.1

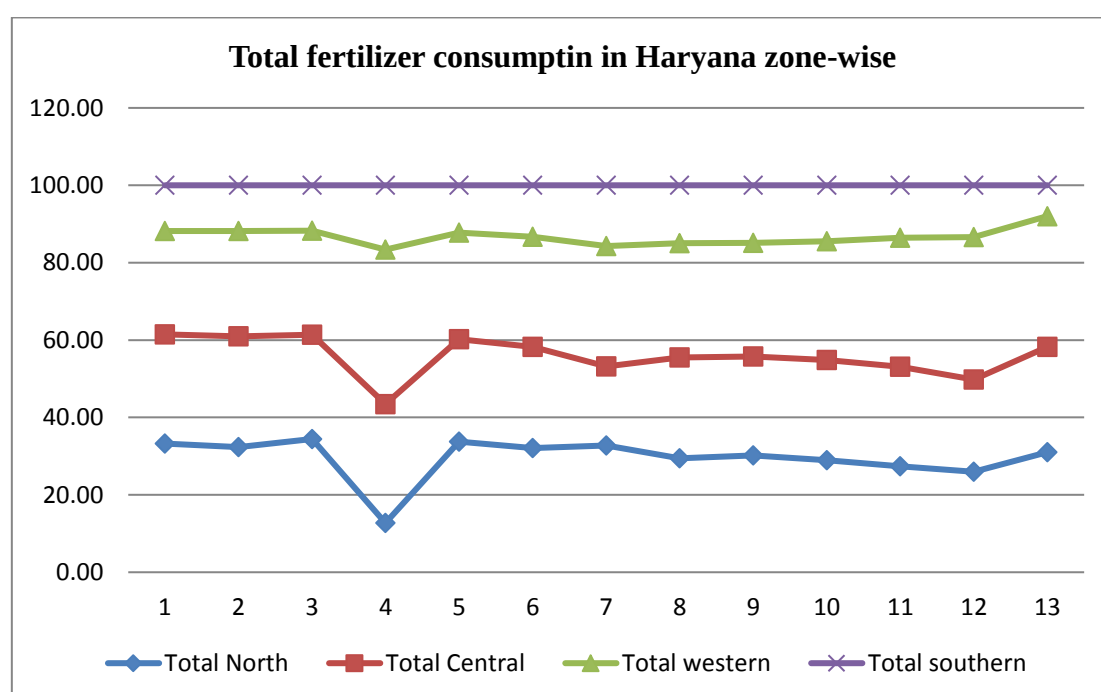


Figure 4.1 Shows total fertiliser consumption in Haryana zone wise. It was lowest during 2004-05 in all zones.

Table 4.2.5 Percentages share of fertilizer consumption in Haryana zone-wise (2001-02 to 2014-15)																
Fertilizer	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2012-13	2013-14	2014-15	CAGR	C.V
Nitrogenous	Northern	33.74	32.64	34.94	38.54	36.97	29.64	31.00	29.81	31.83	26.45	32.60	28.88	25.73	3.09	9.52
	Central	28.58	28.58	27.07	21.66	29.25	27.89	26.16	26.22	25.82	27.46	25.51	25.07	25.35	1.98	12.52
	Western	26.44	27.23	26.73	28.43	20.85	29.48	28.68	29.03	28.60	32.11	23.09	29.12	29.82	0.25	21.92
	Southern	11.23	11.54	11.26	11.37	12.93	12.99	14.17	14.93	13.76	13.98	18.79	16.94	19.10	-2.64	21.42
Phosphatic	Northern	30.45	29.98	31.45	32.17	31.77	28.82	28.12	28.61	23.00	28.05	19.28	19.95	18.42	8.87	11.58
	Central	27.71	29.34	27.18	27.69	26.05	25.26	24.44	27.40	19.86	25.58	24.11	42.42	15.26	9.61	15.66
	Western	27.94	27.56	27.90	27.24	28.45	29.82	31.13	33.78	24.25	28.68	30.55	33.24	52.05	0.47	22.70
	Southern	13.91	13.12	13.47	12.90	13.73	16.11	16.30	10.21	12.89	17.69	26.06	04.39	14.27	4.84	64.55
Potassic	Northern	61.42	62.64	52.33	53.22	48.27	45.97	42.08	46.70	36.84	36.83	29.86	32.12	33.91	-2.70	41.51
	Central	13.42	12.46	15.81	17.46	21.01	15.09	20.61	23.71	16.49	19.18	24.01	18.99	18.04	-8.70	60.46
	Western	21.38	20.60	24.66	22.54	20.74	26.08	21.77	23.94	27.67	28.10	29.55	30.31	30.44	-9.07	69.89
	Southern	03.78	04.30	07.20	06.78	09.98	12.86	15.54	05.65	19.00	15.89	16.59	18.58	17.61	-16.44	78.90
Total	Northern	33.24	32.31	34.44	12.72	33.77	32.10	32.79	29.46	30.19	28.96	27.37	25.97	30.98	2.75	10.81
	Central	28.23	28.61	26.90	30.73	26.48	26.15	20.39	26.03	25.52	25.88	25.74	23.82	27.21	19.30	10.81
	Western	26.75	27.22	26.96	39.93	27.53	28.48	31.14	29.55	29.38	30.73	33.32	36.84	33.83	0.82	10.94
	Southern	11.70	11.85	11.70	16.62	12.22	13.27	15.69	14.97	14.91	14.43	13.56	13.38	07.97	22.47	12.38
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)																

The table 4.2.5 shows fertilizer consumption in Haryana zone wise. Percent share of fertilizer nitrogenous was decreased in northern and central zones. Whereas it is increased in western and southern zones. Percentage of phosphatic was decreased in northern and central zones, whereas it increased in other three zones. Except southern zone percentage share of consumption K increased in other three zones. Except western zone total fertilizer consumption decreased in other three zones. There is much disparity in consumption of fertilizer in Haryana. CAGR in case of nitrogenous is negative in southern zone. Highest CAGR in northern zone, it was followed by central and western zone. In case of consumption phosphatic, highest in northern zone with 8.87 percent whereas lowest in western zone with 0.25 percent during the period. In case of K CAGR is negative in all zones. Total fertilizer highest in southern zone, whereas lowest in western zone with 0.82.

Lowest disparities in use of nitrogenous consumption in northern zone. And in use of consumption phosphatic, highest disparities in southern zone, and in use of consumption K, highest disparities in southern zone. There are not much disparities in total fertilizer consumption over the period.

4.2.6) Consumption of Pesticides

Pesticide is a chemical preparation for destroying plant, fungal, or animal pests. Use of pesticides in India began in 1948 when DDT (dichloro diphenyl tri chloroethane) was imported for malaria control and BHC (benzene hexachloride) for locust control. India started pesticide production with manufacturing plant for DDT and BHC, HCH (hexachloro cyclohexane) in the year 1952. In 1958, India was producing over 5000 metric tonnes of pesticides. Currently, a total of 215 pesticides are registered for manufacture and use in India. Pesticide is manufactured as technical grade products and consumable pesticides are then formulated the installed capacity of technical grade pesticide was 1, 45,800 tonnes during march 2005, and the production in the financial year 2004-05 was 94,000 tonnes. The annual growth of pesticide production between the years 2001 to 2005 was 14.9%.

Benefits of Pesticides

- **Improving Productivity**

Food grain production, which stood at a mere 50 million tonnes in 1948-49, had increased almost fourfold to 198 million tonnes by the end of 1996-97 from an estimated 169 million hectares of permanently cropped land. This result has been achieved with the use of high yield varieties of seeds, advanced irrigation technologies and agricultural chemicals⁴.

- **Protect Crop losses**

In medium land rice even under puddle conditions during the critical period warranted an effective and economic weed control practice to prevent a reduction in rice yield due to weeds that ranged from 28 to 48% based on comparisons that included control (weedy) plots⁵.

- **Quality of Food**

In the countries of first world, it is now observed that a diet containing fresh fruit and vegetables far outweigh potential risks from eating very low residues of pesticides in crops⁶.eating fruit and vegetables regularly reduces the risk of many cancers, high blood pressure, heart disease, diabetes, stroke, and other chronic diseases.

The table 4.2.6 shows the percentage share of consumption of pesticides in Haryana zone-wise. It is increased in northern zone, whereas decrease in central and southern zones. Percentage share of pesticides in northern zone is highest during 2008-09. There is not much disparity in southern zones, it is increased 14.2 per cent to 7.15 per cent during 2001-02 to 2014-15. CAGR was positives highest in southern zone and lowest in western zone, 6.81 and 1.51 per cent respectively. It was negative in northern zone. C.V shows highest variation in consumption of pesticides in southern zone and lowest in central zone over the period.

⁴ Employment Information: Indian Labour Statistics 1994. Chandigarh: Labour Bureau, Ministry of Labour, 1996

⁵ Behera, Basudev, Gauri Shankar Singh. (1999) Studies on Weed Management in Monsoon Season Crop of Tomato. Indian Journal of Weed Science, Vol. 31

⁶ Brown, Ian UK Pesticides Residue Committee Report (2004)

Table 4.2.6 Zone wise percentage share of consumption pesticides in Haryana				
Years	Northern Zone	Central Zone	Western Zone	Southern Zone
2001-02	31.99	23.96	29.42	14.62
2002-03	29.13	20.76	36.78	13.32
2003-04	28.21	20.84	37.49	13.46
2004-05	29.17	20.53	37.04	13.26
2005-06	29.28	20.40	37.20	13.12
2006-07	29.39	20.22	37.43	12.96
2007-08	29.95	20.18	36.97	12.89
2008-09	46.87	21.25	24.93	06.95
2009-10	41.82	21.65	29.32	07.21
2010-11	41.87	21.65	29.29	07.19
2011-12	36.20	23.87	32.04	07.89
2012-13	41.73	21.81	29.26	07.21
2013-14	41.64	21.84	29.36	07.26
2014-15	41.67	21.85	29.32	07.15
CAGR	-0.41	2.16	1.51	6.81
C.V	18.70	5.57	13.41	21.01
Source: Department of Economic and Statistical Analysis ,Government of Haryana, (2001-2015)				

Figure 4.2

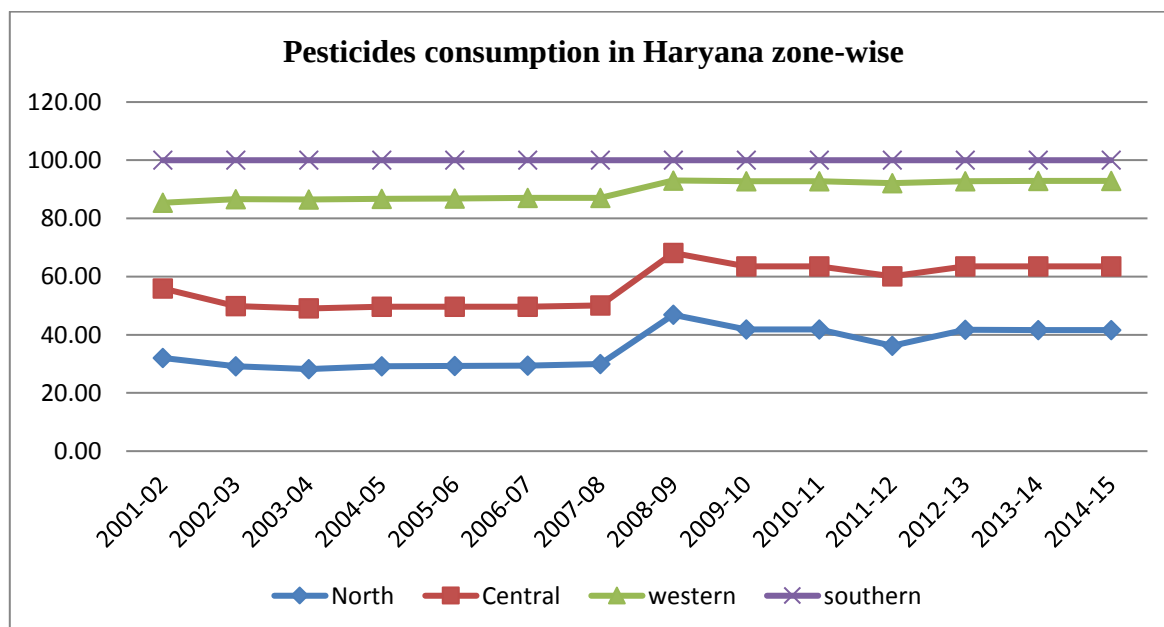


Figure 4.2 Shows consumption of pesticides in Haryana zone-wise during 2001 to 2015. It was highest in 2008-09 in all zones of Haryana.

4.2.7) Zone-wise Tractors in Haryana

The productivity of farms depends greatly on the availability use of farm power by the farmers. Agricultural machines increase productivity of land and labour by meeting timeliness of farm operations and increase work out-put per unit time. The different sizes of tractors are manufactured in India ranging from less than 25 HP to more than 45 HP but most popular range is 31- 35 HP. The tractor sales show that their demand is region specific. Punjab, Haryana and western UP constituted the major tractor market in 1980's with 55-57 percent share of total all India states.

Table 4.2.7 Zone-wise percentage shares of tractors in Haryana (2001-02 to 2014-15)				
Years	Northern zone	Central zone	Western zone	Southern zone
2001-02	26.51	27.35	31.81	14.35
2002-03	26.82	27.70	30.42	15.06
2003-04	25.94	29.44	29.38	15.24
2004-05	24.35	27.63	27.57	20.45
2005-06	24.85	32.41	28.14	14.60
2006-07	23.97	28.22	29.46	18.36
2007-08	24.77	26.43	33.21	15.55
2008-09	24.85	32.41	28.14	14.60
2009-10	25.43	27.32	31.14	16.14
2010-11	25.36	27.28	31.28	16.01
2011-12	25.10	27.38	31.39	16.13
2012-13	25.42	27.36	31.36	15.68
2013-14	27.32	29.40	33.71	19.55
2014-15	27.32	29.40	33.71	19.56
CAGR	-1.13	-1.43	-1.33	1.99
C.V	5.46	8.99	9.16	20.79
Source: Department of Economic and Statistical Analysis , Government of Haryana, (2001-2015)				

The table 4.2.7 shows zone wise percentage share of tractors in Haryana. Trend share of tractors was increased in northern zone with 26.51 to 27.32 percentages over the period. In

central zone it was increased 27.35 to 29.40 percentages but it was highest in 2005-06 and 2008-09 with 32.41 percentages during the period. Except southern zone CAGR of tractors was negative in other three zones.

Figure 4.3

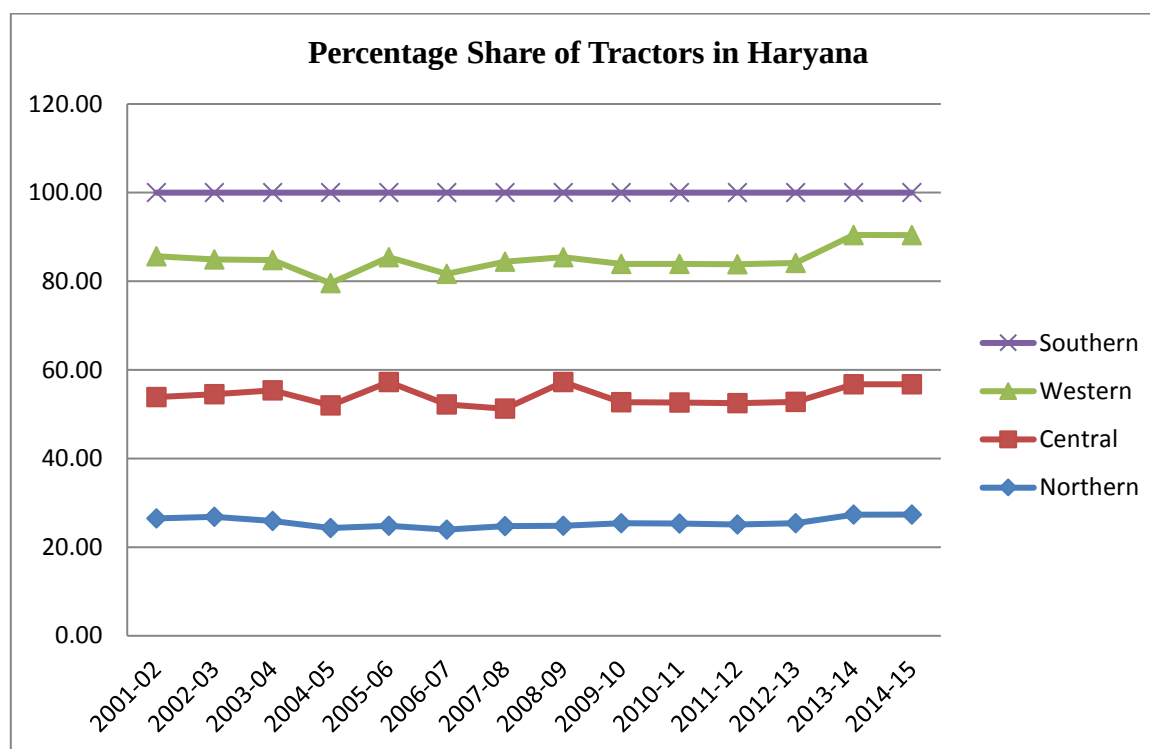


Figure 4.3 Shows zone wise percentage share of tractors in Haryana. It is increased except southern zone.

4.2.8) Agricultural Credit: Agricultural credit is a determinant of agriculture productivity. Large population of India depends on agriculture .For increasing growth of agriculture important role not only purchasing power through creating on farm and off farm employment opportunities but with contribution to price stability. Credit societies provides loan for cultivators in order to help and increase the inputs per unit of area. It also helps farmers invest in credit assets to generate output through technology, method of business management. Credit institutions serving agriculture sector need in three stages. In first stage, which lasted from 1947 to 1969, cooperative agencies provide credit. In second stage after 1969, commercial banks were assigned in providing agriculture credit. In the last stage, from 1975 regional rural banks were established for providing agriculture credit. According to World

Bank paper 1975, “credit is often a key element in the modernisation of agriculture. Not only can credit remove financial constraint but it also accelerates the adoption of new technology. Credit facilities’ are also an integral part of process of commercialisation of the rural economy. However, no amount of credit even at the most reasonable rates can guarantee higher productivity or income among the rural poor, as the success depend upon many factors including the availability of input and services, sound credit policies, well managed institutions and appropriate delivery chann”

Three factors are contributed increased for agriculture growth use of inputs, technologies’ and technical efficiency. The agriculture credit in India existence formal and informal sources of credit supply. An informal source includes friends, relatives, money lenders and traders. On the other hand a formal source includes commercial banks, cooperatives and micro-finance institutions (MFI).

At the time of independence the money lenders are the most important source of agricultural credit. In 1951 the year of beginning of planning in the country, money lenders considered for as much as 71.6 per cent of the rural credit. This primary position of the money lenders was due to the lack of any value with alternative source of rural credit for the farmers. The Government of India measures to help the farmers to meet their needs just like major commercial banks nationalization in 1969 followed by 6 more banks in 1970, the national bank for agriculture and rural development (NABARD) in 1982 and Regional Rural Banks provides both short and medium term loans for agriculture activities.

The national bank for agriculture and rural development (NABARD) is the top institute at the national level for agricultural credit and provides refinance. Reserve Bank has prepared (SACP) Special Agricultural Credit Plans in 1994. Flow of agriculture credit with the beginning of SACP, has increased significantly from 8,255 core rupees in 1994-95 to 1, 22,443 crore rupees in 2006-07 which were higher than 1, 18160 crore rupees. In 2011-12, it was 1, 32,423. During 2007-08, 7.29 million farmers were financed by commercial banks and RRBs as the target of 5 million farmers fixed by UFM for the year. During the period 2011-12, bank has increased level the credit 2, 90,000 crore rupees. Share of agriculture in GDP

has declined during the years, the number of people dependent on agriculture for their food. Credit flows has increased to the agriculture sector.

Table 4.2.8 Targets and actual disbursement to agriculture by banks (rupees crore)								
	(2004-05)		(2006-07)		(2007-08)		(2011-12)	
Agency	Target	Disbursement	Target	Disbursement	Target	Disbursement	Target	Disbursement
Commercial. Banks	57,000	81,481	1,19,000	16,64,486	1,50,000	1,56,850	1,65,000	1,62,000
Cooperative. Banks	39,000	31,231	41,000	42,480	52,000	43,684	62,000	60,000
Regional Rural Banks	8,500	12,404	15,000	20,435	23,000	24, 814	33,000	30,000
Total	1,05,000	1,25,309	1,75,000	2,29,401	2,25,000	2,25, 348	2,60,000	2,52,000
Source: NABARD, RRBS: Regional Rural Banks.								

The table 4.2.8 shows target and the actual disbursements to agriculture by banks of the last four years. In commercial bank target was 57000 and disbursement was 81481 during 2004-05 .but during 2011-12 target was 165000 and disbursement was 162000. In cooperative bank target during 2004-05 was 39000 and disbursements was 41000. whereas in 2011-12 target was 62000 and disbursements was 60000. In case of RRBs target was 8500 and disbursements but 2007-08 target was 23000 and disbursements was 60,000. Total target was 105000 crore and disbursements was 175000 whereas 2011-12 was 1, 60,000 and disbursements was 2, 52,000 crore. Total disbursements were highest to target during 2004-05 but during 2011-12 target was highest comparison to disbursements.

Table 4.2.9 Percentage share of agricultural credit societies in the Haryana for the years 2001-02 to 2014-15

Years	Number of agricultural societies	Number of membership agric. Soc.	Share capital	Own capital	Working capital	Loan advanced	Loan recovered	Over dues
2001-02	15.09	9.29	5.88	7.29	4.18	5.75	5.61	37.71
2002-03	15.02	9.30	6.09	6.03	14.04	7.44	6.38	35.23
2003-04	15.09	9.69	6.46	8.62	4.75	7.20	8.16	16.27
2004-05	14.90	8.71	8.44	4.12	6.93	10.01	9.00	0.84
2005-06	14.90	9.56	7.86	4.12	6.92	9.52	8.46	0.84
2006-07	5.96	1.04	1.19	9.75	1.15	4.71	8.23	0.07
2007-08	3.51	10.10	10.72	10.04	9.54	11.48	10.77	1.45
2008-09	3.81	10.42	12.24	11.92	11.65	7.31	7.67	1.98
2009-10	3.84	10.58	12.46	11.58	12.77	10.09	9.88	2.03
2010-11	3.95	10.60	13.95	12.48	14.28	12.42	12.09	2.06
2011-12	3.93	10.70	14.71	14.05	13.79	14.07	13.75	1.53
2012-13	3.92	10.65	14.72	14.17	13.80	14.27	13.77	1.52
2013-14	3.85	10.62	14.85	14.30	13.89	14.40	13.82	1.51
2014-15	3.80	10.60	14.90	14.36	13.95	14.42	13.90	1.50
Source: Department of Economic and Statistical Analysis, Government of Haryana,(2001-2015)								

The table 4.2.9 shows agricultural credit societies in the Haryana for the years 2001-02 to 2014-15. Percentage share of number of membership, share capital, own capital, working capital, loan advanced and loan recovered were increased during the period, whereas number of agriculture societies was decreased. Number of agricultural societies decrease with 15.09 to 3.80 percentages during the period. Share capital increased with 5.88 to 14.90 percent and working capital increased 4.18 to 13.95 percent during the period. On the other hand overdue was decreased with 37.71 to 1.50 percent during the period.

Table 4.2.10 Percentage share of agriculture credit societies in Haryana (2001-02 to 2014-15)

Items	Number of agricultural societies in Haryana				Membership agriculture Societies in Haryana			
Years	Northern	Central	Western	Southern	Northern	Central	Western	Southern
2001-02	25.02	23.88	31.10	19.99	26.44	25.72	27.59	20.25
2002-03	25.25	23.91	31.28	19.55	26.41	26.03	27.10	20.46
2003-04	25.67	23.76	31.18	19.38	26.86	25.36	27.45	20.34
2004-05	25.87	23.82	30.92	19.38	28.41	29.35	21.12	21.12
2005-06	25.87	23.82	30.92	19.38	25.89	26.75	28.12	19.24
2006-07	27.72	17.97	34.19	20.12	22.43	28.63	29.15	19.79
2007-08	30.72	23.91	26.53	18.85	27.59	26.68	26.89	18.84
2008-09	35.05	22.67	24.60	17.68	27.95	27.71	25.84	18.51
2009-10	35.51	22.61	24.36	17.52	27.92	27.55	26.14	18.39
2010-11	37.00	22.14	23.84	17.03	28.17	27.30	26.13	18.39
2011-12	36.14	22.27	24.30	17.29	28.14	27.54	26.01	18.31
2012-13	35.86	20.99	26.82	16.33	27.91	27.51	25.94	18.65
2013-14	36.01	20.99	26.53	16.47	27.92	27.46	25.95	18.67
2014-15	35.82	20.91	26.61	16.67	27.94	27.42	25.98	18.66
CAGR	6.79	10.53	10.78	11.03	-1.50	-1.56	-0.64	-0.53
C.V	55.44	77.85	80.73	78.25	10.76	8.21	9.51	3.19

Source: Department of Economic and Statistical Analysis, Government of Haryana, (2001-2015)

The table 4.2.10 shows number of agriculture credit and number of membership in Haryana zone wise. In northern zone percentage share of number of agricultural societies increased with 25.01 to 35.82 in Haryana during the period. In central zone and western zone it was decreased. Percentage share of membership agricultural societies was increased in northern and central zones and decreased in western and southern zone of Haryana. CAGR was positively in number of societies over the period. It was highest in southern zone, but lowest in northern zone. CAGR of number of societies is highest in southern zone compared to other zones. CAGR of membership was negatively recorded. Highest variations in number of agricultural societies in Haryana in western zone and in case of membership agricultural societies in northern zone over the period.

The table 4.2.11 shows share capital and own capital in Haryana zone-wise. Percentage share of share capital was increased in northern and central zones of Haryana during the period. Own capital was increased in central and western zone during the period .In southern zone it was decreased with 14.15 to 18.45 percent over the period. CAGR was negative recorded in all zone of Haryana in share capital and own capital. Highest negative CAGR of share capital in northern zone on the other hand own capital CAGR was highest in central zone. C.V shows highest variation in share capital and own capital in Haryana. Highest variation in central zone in case of share capital of agriculture credit societies in Haryana, whereas in case of own capital, highest variations in northern zone.

Table 4.2.11 Percentages shares of agriculture credit societies (2001-02 to 2014-15)								
Items	Share capital of agriculture credit societies in Haryana				Own capital agriculture credit societies in Haryana			
Years	Northern	Central	Western	Southern	Northern	Central	Western	Southern
2001-02	31.49	21.71	30.99	15.81	30.05	17.93	27.84	24.18
2002-03	32.39	21.41	29.94	16.25	27.46	19.02	29.00	24.52
2003-04	31.00	21.94	31.34	15.72	28.49	18.25	26.63	26.63
2004-05	32.10	22.89	29.22	15.78	44.61	18.33	18.01	19.05
2005-06	34.45	20.74	31.36	13.45	41.90	17.21	23.00	17.89
2006-07	28.79	25.97	34.34	10.90	57.02	12.96	16.57	13.45
2007-08	31.82	22.36	31.14	14.68	33.42	21.89	30.33	14.36
2008-09	30.82	22.41	32.43	14.34	22.06	31.99	34.95	11.01
2009-10	32.15	19.74	32.43	15.68	30.29	22.40	32.93	14.38
2010-11	31.87	23.44	30.42	14.27	31.65	23.10	31.60	13.65
2011-12	31.64	23.09	30.87	14.41	29.52	21.09	36.49	12.89
2012-13	28.84	25.29	32.84	13.03	30.43	23.48	32.37	13.71
2013-14	31.87	23.44	30.42	14.27	31.65	23.10	31.60	13.65
2014-15	35.09	21.85	29.33	13.72	30.06	24.34	30.14	15.45
CAGR	-6.88	-6.20	-5.79	-5.20	-3.88	-5.95	-4.42	-0.75
C.V	33.29	37.26	34.44	31.49	49.22	48.84	46.02	25.87
Source: Department of Economic and Statistical Analysis, Haryana, (2001-2015)								

The table 4.2.12 shows working capital and loan advanced in Haryana zone wise. Except southern zone, percentage share of working capital is increased in other three zones during the period. Percentage share of loan advanced increased in central and western zone during the period. CAGR of share capital and working capital was negative in all zones of Haryana. Highest disparities in central zone in case of working capital and lowest in southern zone. On the other hand in case of loan advanced southern zone have lowest disparities.

Table 4.2.12 Percentage shares of agriculture credit societies (2001-02 to 2014-15)								
	Working capital agriculture credit societies in Haryana				Loan advanced agriculture credit societies in Haryana			
Years	Northern	Central	Western	Southern	Northern	Central	Western	Southern
2001-02	29.93	24.10	25.78	20.19	31.84	24.99	24.89	18.28
2002-03	30.56	25.37	22.19	21.88	27.84	25.81	22.48	23.87
2003-04	26.36	21.23	23.09	29.32	28.78	23.32	26.59	21.31
2004-05	32.96	22.71	24.60	19.74	32.68	24.42	23.88	19.03
2005-06	33.03	22.76	24.65	19.55	34.35	20.54	25.10	20.00
2006-07	32.38	20.25	29.61	17.76	50.30	14.89	14.56	20.24
2007-08	32.86	21.60	25.57	19.96	35.45	12.96	28.70	22.89
2008-09	32.91	23.36	25.90	17.83	29.52	23.02	28.07	19.39
2009-10	31.09	24.70	25.36	18.85	29.35	27.22	27.16	16.26
2010-11	31.08	23.81	24.25	20.86	30.18	25.36	25.61	18.85
2011-12	36.59	21.84	28.51	13.06	26.92	28.19	26.60	18.29
2012-13	29.28	26.46	21.36	22.91	31.93	27.45	24.60	16.02
2013-14	29.18	26.48	21.40	22.94	31.46	27.04	24.28	17.22
2014-15	29.47	26.46	21.28	22.79	32.24	25.41	22.40	19.95
CAGR	-9.14	-9.85	-7.99	-10.03	-7.32	-8.07	-7.36	-7.81
C.V	51.19	56.26	49.45	55.21	34.18	45.29	34.65	29.14
Source: Department of Economic and Statistical Analysis , Government of Haryana,(2001-2015)								

The table 4.2.13 shows loan covered and over dues in Haryana zone wise during 2001 to 2014-15. Loan recovered increased in central and western zone over the period. In northern and southern zone it is decreased. Over dues increased in northern and western zone over the period. Except western zone CAGR under loan recovered was negative recorded in other three zones. On the other side CAGR in over dues it was positive in northern and southern zone with 27.18 to 28.76 percent respectively. Highest variations in northern in case of loan recovered, on the other hand in case of over dues highest variations in western zone.

Table 4.2.13 Percentage shares of agriculture credit societies (2001-02 to 2014-15)								
Items	Loan recovered agriculture credit societies in Haryana				Over dues agriculture credit societies in Haryana			
Years	Northern	Central	Western	Southern	Northern	Central	Western	Southern
2001-02	32.82	25.03	24.08	18.07	33.66	23.43	23.89	19.01
2002-03	24.90	30.02	25.19	19.90	34.44	24.32	27.12	14.13
2003-04	25.70	29.70	22.81	21.79	31.09	24.91	26.43	17.56
2004-05	31.94	24.51	23.74	19.81	29.22	25.73	27.14	17.91
2005-06	33.97	26.06	25.24	14.73	29.22	25.73	27.14	17.91
2006-07	31.83	26.48	26.56	15.13	32.32	17.14	12.88	37.65
2007-08	28.48	25.99	24.75	20.78	33.97	22.63	24.57	18.84
2008-09	30.13	22.26	28.16	19.45	31.31	23.93	27.98	16.78
2009-10	27.37	26.39	27.03	19.21	34.45	22.05	27.92	15.57
2010-11	29.35	26.52	26.27	17.87	34.60	20.60	27.75	17.05
2011-12	31.04	26.04	25.76	17.16	34.01	21.81	26.69	17.49
2012-13	32.38	27.20	25.25	15.17	36.86	16.93	27.91	18.30
2013-14	32.43	26.93	25.51	15.13	36.83	17.06	28.08	18.03
2014-15	32.37	27.18	25.29	15.16	37.02	16.96	27.86	18.15
CAGR	-7.21	-7.35	8.88	-6.14	27.18	-5.70	-8.85	28.76
C.V	39.21	36.37	35.33	28.20	49.02	39.40	49.87	41.19
Source: Department of Economic and Statistical Analysis , Government of Haryana,(2001-2015)								

4.3 Disparities in Agriculture Production and Agricultural Inputs Districts-wise in Haryana

The table 4.3.1 shows canal irrigation in Haryana district-wise. Percentage share of canal irrigation was increased in kurukshatra, Jhajjar, Jind and Sirsa whereas, other fifteen districts was decreased. Zero CAGR in panchukula and Yamunanagar. CAGR was recorded negative in kurukshatra, Panipat, Jhajjar, Jind and Sirsa with values of -3.58, -0.72, -0.39,-1.94 and -0.12 percent respectively over the period. Highest positive CAGR in Faridabad with 25.85 percent, it was followed by Gurgaon, Ambala, Sonipat, Kaithal, Rewari, Karnal, with 21.90, 11.63, 9.60, 8.60, 5.08 and 4.86 percent respectively. Lowest growth rate in Fatehbad .There are not much disparities in Panchkula and Yamunanagar. Highest disparities in canal irrigations in Mahendragarh, it was followed by Rewari, Kaithal, Gurgaon and Karnal canal irrigation in Haryana.

The table 4.3.2 shows percentage of tube well irrigation in Haryana district wise. Percentage share of Tube well irrigation was increased in Ambala, Panchkula, Yamunanagar, Kaithal, Karnal, Sonipat, Rohtak, Jhajjar, Gurgaon, Jind and Hisar. There are not much disparities in trend share in Ambala, Kurukshatra and Panipat. CAGR is negatively recoded in Ambala, Panhukula, Yamunanagar, Kaithal, Karnal, Sonipat, Rohtak, Jhajjar, Gurgaon, Rewari, Fatehabad and Sirsa with 0.56, -3.99,-0.58, -4.59, -2.03, -2.33, -2.76, -3.09, -1.58, -12.72, -0.64 and -2.29 percent respectively. Highest positive CAGR in Faridabad with 8.74 it was followed by Bhiwani, Jind and Kurukshatra with 8.54, 3.54 and 1.59 respectively. Lowest in Panipat with 0.11 percent .There are not much disparity in CAGR of Panipat and Mahendergarh over the period. Lowest disparities in Ambala and Rewari with 5.27 and 8.69 percent coefficient of variation respectively.

Table 4.3.1 District –wise percentage share canal irrigation in Haryana (2001-2 to 2014-15)

Years / Districts	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Ambala	08.28	07.69	09.47	09.47	08.28	08.28	08.88	08.28	08.28	08.28	08.28	02.37	02.37	01.78	11.63	38.77
Panchkula	06.25	06.25	06.25	06.25	06.25	06.25	06.25	06.25	06.25	18.75	06.25	06.25	06.25	06.25	0.01	46.77
Yamunanagar	06.98	06.98	06.98	06.98	09.30	06.98	06.98	06.98	06.98	06.98	06.98	06.98	06.98	06.98	0.02	18.70
Kurukshatra	06.59	06.59	06.59	06.59	06.59	06.59	06.59	06.59	06.59	07.56	06.83	06.83	08.54	10.98	-3.58	17.28
Kaithal	08.80	08.80	08.00	08.80	08.80	08.80	08.80	08.80	08.89	08.62	08.09	00.89	01.16	02.76	8.65	42.59
Karnal	09.56	09.15	07.65	04.64	04.64	09.29	09.97	10.25	09.29	05.87	04.78	04.92	05.05	04.92	4.86	32.70
Panipat	07.24	04.39	04.39	03.62	07.49	07.49	07.49	07.24	08.79	08.79	07.24	08.53	09.30	08.01	-0.72	24.76
Sonipat	07.38	07.47	07.47	07.47	07.56	07.38	07.56	07.56	07.56	07.56	06.67	08.10	08.19	02.05	9.60	21.09
Rohtak	08.22	09.04	07.41	06.84	09.12	09.12	07.41	07.25	05.46	06.03	06.03	06.03	06.03	06.03	2.25	18.18
Jhajjar	07.37	07.68	07.68	07.16	05.71	04.05	05.81	08.09	08.09	08.20	07.37	07.68	07.37	07.78	-0.39	16.36
Faridabad	14.62	15.79	13.45	13.45	12.87	09.36	09.36	08.77	00.58	00.58	00.00	00.58	00.00	00.58	25.85	39.35
Gurgaon	17.78	16.67	17.78	17.78	17.78	01.11	01.11	01.00	02.22	02.22	02.22	01.11	01.11	01.11	21.90	43.35
Rewari	07.69	03.85	07.69	06.00	07.69	07.69	07.69	07.69	07.69	07.69	07.69	15.38	07.69	03.85	5.08	46.55
Mahendergarh	09.09	09.09	06.06	06.06	06.06	06.06	24.24	03.03	06.06	06.06	06.06	03.03	03.03	06.06	2.94	53.68
Bhiwani	07.99	07.87	09.24	09.41	10.01	08.76	08.53	08.53	04.50	04.97	04.97	05.03	05.09	05.09	3.27	28.72
Jind	06.79	06.84	06.84	07.81	06.64	06.54	06.44	06.38	05.46	05.77	09.86	06.79	08.89	08.94	-1.94	17.75
Hisar	08.10	07.33	07.90	06.90	07.24	07.24	07.27	07.27	07.24	06.84	06.94	06.84	06.74	06.17	1.96	11.69
Fatehabad	07.68	07.68	07.91	07.91	08.19	03.84	04.07	07.46	07.46	07.06	07.63	07.57	07.97	07.57	0.11	19.30
Sirsa	07.91	07.08	07.30	07.30	07.27	04.56	06.47	06.69	06.58	07.24	06.94	07.91	08.71	08.05	-0.12	13.56

Source: Department of Economic and Statistical Analysis , Government of Haryana , (2001-2015)

Table 4.3.2 District –wise percentage share of tube -wells in Haryana (2001-2 to 2014-15)																
Years / Districts	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Ambala	6.90	7.33	6.76	7.90	7.19	7.47	6.83	7.05	6.98	6.98	6.41	7.33	7.40	7.47	-0.56	5.27
Panchkula	10.00	8.46	4.62	5.38	1.54	1.54	2.31	3.85	3.85	10.77	8.46	10.00	11.54	17.69	-3.99	45.09
Yamunanagar	7.29	7.42	7.49	7.56	7.49	7.35	7.35	0.76	8.38	7.70	7.70	7.84	7.77	7.90	-0.58	26.05
Kurukshatra	7.18	7.18	7.24	7.24	7.24	7.30	7.24	7.30	5.94	7.06	7.24	7.24	8.59	6.00	1.29	8.64
Kaithal	5.16	5.16	5.76	5.16	5.16	5.40	5.34	5.46	7.14	6.24	11.46	11.52	11.10	9.96	-4.59	36.62
Karnal	5.76	6.40	6.55	7.97	7.92	6.45	6.10	6.05	7.92	7.58	8.12	7.68	7.82	7.68	-2.03	12.09
Panipat	6.91	8.21	7.56	8.53	6.91	6.70	7.02	7.34	6.91	6.59	7.34	6.80	6.37	6.80	0.11	8.53
Sonipat	9.22	7.41	7.72	6.01	5.61	5.81	6.71	7.01	4.11	6.71	7.01	7.82	6.01	12.83	-2.33	48.47
Rohtak	5.62	5.62	4.49	9.21	6.74	4.49	6.74	5.39	10.11	8.54	8.54	8.54	7.64	8.31	-2.76	25.35
Jhajjar	6.71	5.62	6.99	11.64	6.03	9.04	7.95	6.03	4.79	5.75	4.66	7.81	6.58	10.41	-3.09	28.68
Faridabad	10.17	10.06	9.43	7.55	9.96	8.81	10.38	9.43	7.34	3.67	3.46	3.35	3.25	3.14	8.74	32.35
Gurgaon	6.18	7.05	6.96	9.76	7.15	7.15	7.25	6.67	7.25	6.67	5.41	7.15	7.63	7.73	-1.58	13.37
Rewari	6.78	6.51	7.33	8.07	7.33	7.26	6.38	7.26	6.24	7.26	6.45	7.26	7.39	8.48	-1.58	8.69
Mahendergarh	8.75	9.12	8.90	9.27	8.90	2.39	5.76	6.06	8.98	9.27	3.52	8.83	1.65	8.60	0.12	38.66
Bhiwani	5.24	6.60	6.72	3.14	7.27	8.14	8.57	8.63	8.88	7.21	7.15	10.17	10.60	1.66	8.54	34.63
Jind	8.46	7.15	7.23	0.74	7.64	7.64	7.15	6.66	8.63	9.70	10.02	8.46	5.34	5.18	3.57	32.34
Hisar	1.72	2.86	4.20	14.50	1.72	1.72	4.39	6.11	4.20	11.64	12.02	11.64	11.64	11.64	-12.78	46.30
Fatehabad	6.12	5.95	6.28	4.79	4.96	11.90	11.65	6.78	6.61	8.02	7.27	6.86	6.12	6.69	-0.64	29.43
Sirsa	4.56	5.53	5.63	0.00	6.98	7.08	10.09	10.09	10.57	10.57	10.09	7.27	5.24	6.30	-2.29	41.83
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)																

Table 4.3.3 District wise Number of Agriculture Credit Societies in Haryana (2001-2 to 2014-15)																
Years/ Districts	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	C.V	CAGR
Ambala	4.83	4.85	4.70	4.72	4.99	7.35	5.76	7.40	7.17	6.97	7.01	7.02	7.04	6.97	49.77	7.19
Panchkula	1.87	1.91	1.91	1.89	2.14	3.81	1.92	1.77	1.75	1.70	1.71	1.72	1.72	1.70	69.95	10.76
Yamunanagar	4.58	4.93	4.91	5.05	5.15	2.83	5.06	6.27	6.05	6.04	5.14	5.15	5.16	5.11	65.92	9.19
Kurukshatra	4.54	4.48	4.50	4.97	4.65	3.19	6.28	7.07	7.80	9.75	9.66	9.67	9.70	9.75	42.11	3.46
Kaithal	5.47	4.85	4.91	5.42	5.24	3.45	5.24	5.31	5.41	5.26	5.30	5.46	5.48	5.42	68.40	9.52
Karnal	6.08	5.66	6.04	6.16	5.87	4.78	6.81	7.56	7.64	7.59	7.17	7.80	7.98	7.74	58.59	7.43
Panipat	3.89	3.54	3.85	4.07	3.81	1.95	4.89	4.98	5.10	4.95	4.98	4.99	5.01	4.95	59.85	7.75
Sonipat	5.76	5.78	5.76	5.83	5.95	1.95	5.76	5.31	5.25	5.26	4.83	5.15	5.16	5.26	77.15	10.75
Rohtak	2.84	2.93	3.20	2.75	3.56	5.49	3.66	3.54	3.50	3.41	3.43	3.28	3.44	3.41	61.08	8.05
Jhajjar	4.26	4.40	4.34	4.35	5.24	8.41	4.01	3.70	3.66	3.56	3.58	3.59	3.60	3.56	74.04	11.46
Faridabad	5.35	5.34	4.34	4.76	5.74	8.68	5.24	4.82	4.78	4.64	4.67	4.68	4.69	4.64	68.92	10.86
Gurgaon	6.65	6.72	6.69	6.74	6.87	4.43	5.76	5.31	5.25	5.11	5.14	5.15	4.85	4.95	79.98	12.13
Rewari	3.53	3.54	3.89	3.90	3.73	5.31	4.19	4.02	3.98	3.87	3.89	4.06	3.91	4.02	62.95	9.01
Mahendergarh	3.81	3.83	3.45	3.45	3.52	4.78	3.66	3.54	3.50	3.41	3.58	3.59	3.44	3.56	67.13	10.58
Bhiwani	8.23	8.68	8.92	8.38	8.50	4.87	6.98	6.59	6.53	6.35	6.39	6.40	6.42	6.81	81.03	11.54
Jind	6.00	5.91	6.24	5.83	5.99	4.07	5.24	4.82	4.78	4.64	4.67	4.68	4.69	4.64	78.68	11.80
Hisar	8.23	8.43	8.23	8.34	8.50	16.03	8.20	7.56	7.48	7.28	6.85	7.33	7.36	7.28	70.30	11.02
Fatehabad	5.56	5.66	5.96	5.63	4.65	1.86	5.06	4.66	4.62	4.64	4.67	4.68	4.69	4.64	79.97	11.46
Sirsa	8.52	8.55	8.15	7.76	5.91	6.73	6.28	5.79	5.73	5.57	7.32	5.62	5.63	5.57	80.55	13.42
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)																

The table 4.3.3 shows number of credit societies in Haryana district -wise. Trend share of number of agricultural societies has decreased in all districts of Haryana except Rewari, Rohtak, Panipat, Karnal, Kurukshatra, Yamunanagar and Ambala. Highest CAGR in Sirsa with 13.42 percent, it was followed by Gurgaon with 12.13. There are not much disparities in Jhajjar, Bhiwani, Jind, Hisar and Fatehabad, which was 11.46, 11.54, 11.80, 11.02 and 11.46 percent CAGR respectively over the period. There are not much disparities in Yamunanagar and Rewari. CAGR of Sonapat, Faridabad and Panchkula was 10.75, 10.86 and 10.76 respectively over the period. C.V shows variation in number of credit societies in Haryana. Highest disparities in number of credit societies in Bhiwani, Sirsa, Gurgaon, Fatehabad, Jind and Sonapat with 81.03, 80.55, 79.98, 79.97, 78.68 and 77.75 percent coefficient of variation respectively.

The table 4.3.4 shows own capital under agriculture credit societies in Haryana district wise. Except Yamunanagar, Karnal, Jhajjar, Gurgaon, Mahendergarh, Bhiwani and Fatehabad, trend share of own capital was increased in all districts in Haryana over the period. CAGR was positive in Panchkula, Hisar, Fatehabad and Sirsa. Highest disparities in Jind, Hisar and Rohtak districts in own capital under agriculture credit societies in Haryana.

Table 4.3.4 District-wise own capital under agriculture credit societies in Haryana (2001-2 to 2014-15)

Years/ Districts	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Ambala	6.02	5.95	5.50	6.20	5.55	6.01	6.48	7.23	5.73	5.53	4.80	4.92	6.06	8.45	-6.19	31.46
Panchkula	1.61	1.59	1.95	2.29	2.30	2.41	1.58	1.73	1.71	1.76	1.62	1.66	1.89	9.48	3.00	22.78
Yamunanagar	6.34	6.29	5.95	5.82	9.11	4.60	7.40	6.57	6.74	6.65	6.03	6.28	4.89	4.45	-6.00	28.66
Kurukshatra	6.20	6.50	9.31	5.03	5.09	7.37	5.47	5.71	4.65	4.60	4.44	4.45	5.36	5.93	-5.65	21.53
Kaithal	5.85	5.75	4.91	5.88	7.73	7.03	5.68	5.67	5.19	4.97	4.92	5.17	5.85	5.79	-7.50	22.03
Karnal	9.31	9.23	8.49	7.81	3.94	7.20	7.74	6.79	6.72	8.70	8.29	8.93	8.05	8.42	-7.86	34.13
Panipat	4.18	3.80	3.55	3.99	3.78	5.21	4.76	5.25	4.73	4.40	4.17	4.20	4.70	4.48	-12.84	31.13
Sonipat	3.34	3.37	3.17	3.67	4.21	4.91	3.58	4.49	3.43	3.44	3.27	3.43	4.15	3.65	-9.71	27.31
Rohtak	2.61	2.28	2.74	2.33	3.85	3.72	2.69	3.72	2.76	3.35	3.07	3.49	2.22	5.37	-7.37	43.91
Jhajjar	5.72	5.69	5.21	5.85	4.10	3.72	5.94	6.67	7.03	6.97	6.31	7.35	4.42	5.40	-10.99	40.03
Faridabad	3.05	2.28	2.74	2.33	3.85	3.72	2.69	3.72	2.76	3.35	3.07	3.49	2.22	5.37	-9.7	27.34
Gurgaon	3.72	3.70	3.71	4.81	4.59	5.06	3.95	3.98	4.03	3.89	3.54	3.67	2.16	2.61	-9.83	23.68
Rewari	3.74	3.72	3.76	4.63	5.31	5.57	4.07	3.77	3.96	3.85	3.55	4.10	4.92	4.86	-4.93	27.40
Mahendergarh	3.71	3.62	3.34	3.83	5.49	4.59	3.00	2.91	2.80	2.65	2.40	2.71	3.14	2.13	-7.74	15.90
Bhiwani	6.60	6.55	6.06	7.14	6.76	4.02	6.77	6.64	6.88	6.62	12.46	7.25	4.36	4.98	-9.96	51.18
Jind	3.99	4.31	7.67	4.84	4.95	5.30	4.00	3.97	3.99	4.36	3.97	4.04	5.86	9.97	-6.22	47.46
Hisar	7.74	8.03	7.48	7.85	6.40	6.94	10.55	3.40	10.98	10.71	9.71	10.07	11.62	7.28	5.37	45.98
Fatehabad	7.40	7.54	6.73	7.43	6.54	6.25	6.16	6.56	6.20	5.89	6.33	6.40	7.18	7.09	5.19	25.13
Sirsa	8.87	9.06	6.63	7.32	6.83	6.51	6.84	11.58	8.88	8.38	7.78	8.66	9.52	6.53	5.19	36.12

Source: Department of Economic and Statistical Analysis ,Government of Haryana (2001-2015)

Table 4.3.5 District wise working capital under agriculture credit in Haryana (2001-2 to 2014-15)																
Year/ Districts	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Ambala	4.66	4.69	4.70	5.53	6.19	6.04	5.90	7.84	5.59	4.96	5.06	5.74	5.78	8.03	8.62	49.48
Panchkula	8.68	7.86	7.07	5.19	4.62	3.69	2.26	2.14	2.38	2.42	2.37	2.39	2.46	2.90	2.30	61.84
Yamunanagar	4.29	4.34	4.38	4.84	4.82	4.66	4.72	5.51	5.39	5.62	5.32	5.25	5.66	1.73	0.62	53.65
Kurukshatra	4.32	4.35	4.38	5.84	6.06	5.78	5.99	4.90	4.75	4.91	5.10	5.05	5.69	6.63	7.95	46.74
Kaithal	4.51	4.49	4.70	5.84	5.40	5.52	5.52	6.22	6.10	5.86	6.15	6.28	5.47	4.96	6.08	48.32
Karnal	6.67	7.58	5.96	6.59	8.06	7.64	8.14	8.04	7.88	8.20	8.62	7.89	8.35	11.15	10.52	51.81
Panipat	3.88	3.70	4.05	4.16	5.02	5.02	5.24	5.17	5.09	4.97	4.93	4.83	5.03	4.99	6.95	47.49
Sonipat	4.51	4.63	4.99	5.53	5.39	5.52	5.48	5.52	5.54	5.12	5.05	4.97	5.44	6.95	7.97	46.41
Rohtak	2.25	2.15	2.07	2.44	2.41	2.65	2.72	2.67	2.80	2.99	2.89	2.81	3.20	4.55	9.53	58.35
Jhajjar	3.69	3.70	4.05	4.50	3.95	3.95	4.41	4.59	4.82	4.67	4.42	4.76	5.15	6.70	9.10	54.31
Faridabad	3.77	3.91	4.05	5.18	5.08	5.02	5.73	4.71	4.33	5.41	5.64	5.54	5.78	5.99	7.67	52.28
Gurgaon	6.64	6.57	6.42	6.90	6.97	6.57	6.29	7.19	7.96	9.46	9.17	9.21	7.15	8.17	9.34	53.99
Rewari	3.65	3.28	3.38	3.81	3.42	3.43	3.64	3.18	3.76	3.41	3.18	2.63	2.87	2.78	4.05	36.24
Mahendergarh	3.66	3.59	3.71	3.91	3.57	3.43	3.93	3.13	2.80	2.58	2.38	2.59	2.71	2.15	2.64	28.62
Bhiwani	6.00	6.03	5.96	7.24	7.04	7.02	7.15	4.85	6.35	6.03	6.22	6.89	6.48	1.38	-2.29	49.75
Jind	4.14	4.30	5.05	5.53	5.03	6.30	5.52	8.85	5.45	5.18	5.27	5.45	5.75	6.07	7.70	48.31
Hisar	6.00	5.92	5.96	6.59	7.37	8.05	7.71	4.91	8.81	8.33	8.62	8.25	7.50	9.64	11.8	53.85
Fatehabad	3.77	3.91	4.05	4.84	4.58	4.66	4.54	5.58	4.88	4.76	4.54	4.46	4.55	2.46	3.19	45.96
Sirsa	4.89	5.00	5.05	5.53	5.02	5.02	5.12	5.00	5.32	5.13	5.07	5.00	4.95	2.77	2.43	43.11
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)																

The table 4.3.5 shows the district- wise working capital under agriculture credit societies in Haryana. Trend Share of working capital has increased in whole districts except Yamunanagr, Karnal Jhajjar, Gurgaon, Mahendergarh, Bhiwani and Fatehabad during the period. Bhiwani recorded negative growth rate during the study (-2.29 percent) while it is recorded highest positive growth for Hisar followed by Karnal with 10.52 percent respectively. Lowest CAGR of working capital observed in Panchkula (0.62 percent).

The table 4.3.6 shows district-wise loan advanced under agriculture credit societies in Haryana. Trend share of loan advanced increased in all districts of Haryana except Ambala, Gurgaon, Rewari, Mahendergarh and Sirsa. Highest negative CAGR in Bhiwani with -12.79, it was followed by Panchkula Kurukshatra, Rohtak , Panipat, Yamunanagr , Faridabad with 11.80,-11.10,-11.06, -10.90,-10.32,-10.07 percent respectively over the period. Lowest CAGR in Rewari with -4.80. Highest disparities in Panchkula, Kurukshatra and Kaithal district and lowest in Mahendragarh in loan advanced under agriculture credit societies in Haryana,

Table 4.3.6 District wise loan advanced agriculture credit societies in Haryana (2001-2 to 2014-15)																
Years / Districts	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Ambala	6.11	4.05	5.73	5.49	5.78	5.26	4.83	3.35	3.77	3.48	4.22	5.02	4.52	4.42	-7.85	43.62
Panchkula	3.46	2.43	3.23	2.80	2.36	2.26	1.96	2.62	1.73	1.95	1.98	2.05	2.08	4.62	-11.80	73.91
Yamunanagar	5.34	4.03	6.03	5.79	5.15	4.90	4.09	4.62	4.45	4.42	4.33	4.39	4.42	5.64	-10.32	51.17
Kurukshatra	4.90	33.75	5.33	5.21	5.11	5.40	5.36	2.64	3.90	4.57	4.77	4.51	4.19	5.84	-11.10	87.40
Kaithal	4.90	3.71	5.33	4.89	5.24	5.46	5.65	5.31	5.87	5.77	6.18	6.11	5.82	7.24	-12.42	61.36
Karnal	8.47	5.72	8.00	7.16	8.69	8.57	8.18	9.63	8.51	9.48	10.42	10.04	10.69	8.45	-9.96	51.87
Panipat	4.90	3.33	4.37	6.24	5.59	5.46	6.39	6.98	6.00	6.39	5.58	5.01	4.86	5.66	-10.90	47.22
Sonipat	6.22	4.37	6.11	5.53	5.86	4.98	6.58	5.16	4.97	4.30	4.83	4.61	4.81	5.39	-9.04	44.64
Rohtak	3.34	2.17	3.35	3.77	3.25	3.66	3.81	2.91	3.13	3.97	4.24	3.87	4.20	3.96	-11.06	56.08
Jhajjar	7.57	5.23	7.33	6.37	4.89	5.47	5.69	4.63	6.63	5.96	5.39	6.38	6.17	5.15	-7.45	41.87
Faridabad	4.72	3.29	4.58	5.20	5.98	6.06	5.79	4.83	5.57	6.02	6.36	5.36	5.55	4.80	-10.07	46.32
Gurgaon	5.78	3.96	5.73	5.23	5.94	5.99	5.46	7.27	6.03	6.02	5.30	4.84	4.90	3.99	-7.56	32.91
Rewari	3.89	2.64	3.84	3.93	3.48	2.88	2.37	3.65	4.82	3.91	3.61	4.84	4.62	1.78	-4.80	47.26
Mahendergarh	4.36	2.94	4.22	3.93	3.64	3.92	4.12	4.95	2.68	2.57	2.21	2.66	2.35	2.82	-7.13	32.74
Bhiwani	4.46	3.39	4.97	5.23	6.27	6.25	6.59	6.34	6.30	6.71	6.08	7.39	7.80	6.96	-12.79	59.27
Jind	4.36	2.98	4.22	5.23	5.18	4.69	4.79	4.27	5.71	5.47	5.13	6.00	6.18	5.58	-11.54	57.11
Hisar	6.22	4.24	6.11	6.27	7.30	8.06	8.28	9.32	9.51	8.07	7.59	6.56	6.68	7.06	-10.79	46.05
Fatehabad	3.92	2.75	4.09	5.23	4.74	5.26	4.97	4.25	4.62	4.93	5.62	4.80	4.64	4.45	-10.79	48.22
Sirsa	7.10	5.01	7.44	6.52	5.57	5.47	5.10	7.25	5.82	6.00	6.15	5.55	5.52	6.18	-9.07	44.63
Source: Department of Economic and Statistical Analysis , Government of Haryana (2001-2015)																

Table 4.3.7 District wise loan recovery under agriculture credit societies in Haryana (2001-2 to 2014-15)																
Years / Districts	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Ambala	6.22	6.19	6.65	6.12	5.92	5.42	4.90	1.72	3.64	3.72	4.34	5.67	5.84	5.60	4.73	42.93
Panchkula	3.72	3.71	3.24	2.67	2.48	2.27	2.04	1.76	1.35	1.85	2.06	0.85	0.84	0.87	-2.45	25.56
Yamunanagar	6.01	5.99	5.59	5.42	5.43	4.97	3.32	5.58	4.49	4.16	5.10	4.83	4.77	3.10	1.70	28.68
Kurukshatra	5.35	5.33	5.37	5.27	5.13	4.96	5.22	3.27	3.62	4.35	4.96	4.76	4.67	4.38	4.20	34.40
Kaithal	5.69	5.67	5.59	4.96	5.45	5.52	5.73	6.36	5.81	5.92	5.99	6.46	6.80	6.24	5.82	41.45
Karnal	8.09	8.02	7.13	7.22	7.81	7.73	8.16	10.60	8.27	8.65	10.01	10.67	10.81	10.36	6.52	48.17
Panipat	5.00	4.99	4.31	3.72	5.17	5.14	5.89	7.90	6.00	6.63	5.85	5.60	5.71	4.66	4.92	38.85
Sonipat	6.22	6.46	7.04	6.11	5.62	5.52	5.87	2.86	6.27	5.44	4.42	4.51	6.27	3.67	2.42	32.57
Rohtak	6.22	6.46	7.04	6.11	5.62	5.52	5.87	2.86	6.27	5.44	4.42	4.51	6.27	3.67	6.55	44.81
Jhajjar	7.71	7.62	6.02	5.10	4.81	4.89	5.27	5.28	5.81	5.96	5.69	6.12	5.38	6.07	3.99	35.23
Faridabad	4.43	4.37	8.31	7.25	6.63	6.07	5.81	6.92	5.31	5.05	5.11	3.01	2.82	2.67	2.55	24.62
Gurgaon	4.55	4.49	3.98	6.54	6.03	6.07	6.04	7.90	6.22	6.19	5.62	5.10	3.99	3.79	4.31	31.16
Rewari	3.48	3.44	3.50	3.38	3.34	4.34	4.44	4.44	4.78	3.86	3.80	4.47	5.22	5.65	8.02	49.71
Mahendergarh	4.28	4.63	3.98	3.80	3.81	4.06	4.18	4.06	2.90	2.76	2.32	2.59	2.63	3.04	3.43	20.88
Bhiwani	4.91	4.84	4.25	6.46	6.05	6.07	5.76	7.99	6.26	6.91	5.79	7.08	7.09	8.73	8.55	49.08
Jind	4.33	4.28	3.98	4.83	5.37	5.14	4.95	5.27	5.50	5.64	5.09	6.02	5.44	8.21	8.91	52.21
Hisar	5.96	5.88	5.55	7.22	7.36	7.53	8.23	9.50	10.27	8.12	7.55	7.18	6.50	6.06	5.40	35.17
Fatehabad	4.20	4.15	4.69	4.48	4.59	5.13	5.40	4.81	4.77	5.03	5.61	5.08	5.36	6.61	7.85	45.96
Sirsa	6.96	7.07	6.72	5.88	5.74	5.69	5.00	0.78	5.73	6.20	6.33	5.91	5.72	6.69	3.65	43.98
Source: Department of Economic and Statistical Analysis , Government of Haryana(2001-2015)																

The table 4.3.7 shows district-wise loan recovery under agriculture credit societies in Haryana. Trend share of loan recovery in Ambala decreased 6.22 to 5.60 percent during the period. Percentage share of loan recovery in kurukshatra, Karnal, Rewari, Bhiwani, Jind, Hisar and Fatehabad. Lowest loan recovery in Panchkula compared to other district. It was followed by Rohtak and Rewari. Highest CAGR of loan recovery in Jind with 8.91 percent during the period. It was followed by Bhiwani and Rewari with 8.55 and 8.02 percent respectively. Lowest CAGR of loan recovery was 1.70 percent in Yamunanagar. Highest disparities in Jind and lowest in Panchkula in loan recovery under agriculture credit societies in Haryana.

Conclusion

In Haryana irrigated area canal irrigation of northern zone was continuously declined but it was highest in 2009-10 with 11.54 percent; whereas in central zone it was increased. Trend share of canal irrigation in western and southern zone has declined over the study. CAGR in canal irrigated was negative in western zone. It was highest positive in northern zone, but percentage share has been increased. Growth rate of tube-wells negative in western zone whereas highest positive in central zone of Haryana. In case of tube-well highest disparities in western zone with 21.81 percent coefficient of variation whereas lowest in northern zone with 4.21 percent coefficient of variation. CAGR of area under HYV seeds for the crop rice was negative in all zones of Haryana. Growth rate of area under HYV for crop wheat positive in three zones except southern. CAGR of bajra negative in all zones of Haryana. CAGR under crop maize positive highest in central with 2.82, it was followed by northern, southern and western zones respectively. CAGR of total fertilizer highest in southern zone, whereas lowest in western zone. Consumption of pesticides is increased in northern zone, whereas decrease in central and southern zones. Rainfall was increased in northern, central and

southern zones, whereas it was decreased in western zone. Highest variations in rainfall in southern zone with 25.29 percent.

Percentage share of number of membership, share capital, own capital, working capital, loan advanced and loan recovered were increased during the period, whereas number of agriculture societies was decreased. Number of agricultural societies decrease with 15.09 to 3.80 percentages over the study. Share capital increased with 5.88 to 14.90 percent and working capital increased 4.18 to 13.95 percent over the study. On the other hand overdue was decreased with 37.71 to 1.50 percent during the period.

Major Findings

- Out of total area irrigation by tube-well irrigated maximum as comparison to canal and other sources of irrigations.
- Trend share of wheat increased in three zones except southern zone of Haryana. Area under HYV under bajra increased in all zones.
- Except southern zone CAGR of tractors was negative in other three zones.
- Consumption of pesticides is increased in northern zone, whereas decrease in central and southern zones.
- Number of membership, share capital, own capital, working capital, loan advanced and loan recovered of agricultural credit societies was increased over the study, whereas number of agriculture societies was decreased.
- In case of canal irrigation CAGR was negative recorded in kurukshatra, Panipat, Jhajjar, Jind and Sirsa with -3.58, -0.72, -0.39,-1.94 and -0.12 percent respectively over the period. Highest positive CAGR in Faridabad with 25.85 percent, it was followed by

Gurgaon, Ambala, Sonipat, Kaithal, Rewari, Karnal, with 21.90, 11.63, 9.60, 8.60, 5.08 and 4.86 percent respectively.

- Percentage share of tube well irrigation was increased in Ambala, Panchukula, Yamunanagar, Kaithal, Karnal, Sonipat, Rohtak, Jhajjar, Gurgaon, Jind and Hisar.
- Rainfall was increased in Karnal, Panipat, Sonipat, Jhajjar, Faridabad, Gurgaon, Jind, Fatehabad and Sirsa during the period.
- Highest disparities in canal irrigations in Mahendragarh, followed by Rewari, Kaithal, Gurgaon and Karnal canal irrigation in Haryana.
- Highest disparities in Kaithal with 45.62 and lowest in Yamunanagar with 11.27 percent rainfall.

CHAPTER-5
**REGIONAL
DISPARITIES IN
AGRICULTURAL
GROWTH IN HARYANA**

CHAPTER - 5

REGIONAL DISPARITIES IN AGRICULTURAL GROWTH IN HARYANA

5.1) Introduction

This chapter is an attempt to analyse the regional disparities in agricultural growth in Haryana (district-wise & zone-wise). Agricultural growth refers as cropping pattern, area, production and productivity of selected major crops. This chapter divided in 2 sections. In the first section, the percentage share, CAGR (compound average growth rate) and σ -convergence have been used to measure the disparities in areas, production and productivity under cultivation of main crops. In second section used σ -convergence and β -convergence to measure the disparities in agricultural growth. σ -convergence convergence model used for the dispersion of area, production and productivity over the districts decreases over time. This study is based on calculating the Standard Deviation (SD) across zone-wise in Haryana for each year from 2001 to 2015.

5.2) Zone-wise area under cultivation of various crops

Disparity in area under cultivation of selected major crops have shown in table 5.1

The table 5.2.1 shows that the crop wise and zone wise percentage share in area under cultivation during the period (2001 to 2015).

Table 5.2.1 Area under cultivation of food grains crops in Haryana (2001-2 to 2014-15)

Years / Crops	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Rice	Northern	39.90	38.51	49.40	48.65	48.88	47.07	43.65	46.33	39.58	42.51	43.03	35.32	44.41	52.85	2.03	14.12
	Central	41.23	43.09	32.84	33.78	32.98	33.80	35.58	33.63	37.43	36.83	35.12	42.39	32.61	43.29	0.35	13.72
	Western	14.93	13.98	15.45	13.95	14.72	15.52	16.85	16.21	18.79	16.42	17.29	20.34	21.25	2.14	-12.97	31.87
	Southern	3.93	4.42	2.32	3.62	3.42	3.61	3.93	3.83	4.20	4.23	4.56	1.94	1.72	1.72	-5.71	35.29
Wheat	Northern	21.88	28.86	24.28	22.92	23.33	25.23	22.23	21.83	22.72	23.48	22.26	23.63	24.14	23.94	0.64	9.11
	Central	29.57	28.10	26.06	29.85	29.59	24.40	30.15	29.47	29.57	30.70	29.55	31.86	31.00	31.52	0.46	9.91
	Western	32.66	29.30	33.87	32.20	32.55	35.28	33.07	34.44	34.11	31.28	34.25	37.23	37.83	37.27	0.95	7.40
	Southern	15.90	13.74	15.79	15.03	14.53	15.09	14.56	14.26	13.60	14.54	13.94	7.29	7.02	7.28	-5.43	24.78
Bajra	Northern	0.92	0.76	0.72	0.51	0.10	0.90	0.73	0.79	0.86	0.70	0.50	0.46	0.87	0.81	-0.90	34.25
	Central	16.29	15.83	18.69	17.09	15.04	22.60	20.90	20.87	20.20	20.70	19.08	19.04	21.25	22.30	2.27	17.19
	Western	44.68	44.60	52.48	44.74	46.96	23.91	39.90	41.45	40.79	39.01	44.59	41.48	32.12	19.37	-5.80	34.39
	Southern	38.11	38.81	28.11	37.66	37.89	52.58	38.47	36.88	38.15	39.59	35.83	39.01	45.76	57.52	2.98	34.17
Total cereals	Northern	24.94	25.15	25.64	25.37	26.21	25.53	24.75	24.41	24.52	25.07	24.44	26.18	27.81	26.44	0.42	3.50
	Central	30.811	30.799	30.085	29.529	29.580	29.608	30.058	29.762	30.411	30.107	30.087	32.067	32.770	33.513	0.60	4.85
	Western	27.20	27.88	30.18	29.00	29.34	30.04	29.78	30.47	30.38	29.89	30.26	31.96	31.56	31.56	1.07	6.63
	Southern	17.05	16.17	14.09	16.10	14.87	14.82	15.42	15.36	14.69	14.94	15.21	9.79	7.87	8.49	-4.86	22.75
Maize	Northern	88.68	91.06	91.19	90.96	93.04	94.25	94.78	92.75	87.88	80.33	86.32	75.00	71.19	69.15	-1.76	26.37
	Central	5.66	2.79	1.89	7.23	5.06	4.60	4.48	5.80	3.79	18.85	12.63	18.75	21.19	13.83	6.59	23.97
	Western	0.63	1.12	1.26	0.60	0.63	1.15	1.12	0.72	0.78	0.82	0.91	3.13	3.39	10.64	22.39	53.12
	southern	5.03	5.03	5.66	1.20	1.27	0.75	0.75	0.72	8.33	1.3	1.05	3.13	4.24	6.38	1.71	63.12
Gram	Northern	1.67	0.98	3.11	0.98	1.34	1.02	1.03	0.84	1.76	0.83	0.63	0.89	1.06	0.45	-8.90	47.54
	Central	1.33	5.40	9.51	3.60	0.29	1.56	2.24	1.86	1.76	2.26	1.61	2.03	3.18	1.36	0.12	55.13
	Western	89.25	82.04	72.03	77.74	92.07	90.22	88.71	86.95	86.54	91.92	87.38	87.31	79.03	82.94	-0.52	28.89
	Southern	7.75	11.58	15.36	17.68	6.31	7.20	8.02	10.34	9.94	4.99	10.38	9.77	16.74	15.25	4.96	41.63
Total pulses	Northern	7.32	6.01	5.82	5.03	5.18	4.66	5.73	4.94	5.18	6.53	3.82	6.10	9.42	7.08	-0.24	20.64
	Central	9.55	11.02	13.34	17.38	15.49	15.16	16.01	15.47	15.96	13.98	10.31	11.29	13.57	11.68	1.44	37.21
	Western	71.97	70.31	67.20	62.57	70.16	68.87	69.46	67.03	68.95	72.49	75.04	74.75	64.96	62.98	-0.95	26.67
	Southern	11.15	12.66	13.65	15.03	9.17	11.32	8.80	12.56	9.92	6.99	10.83	7.86	12.05	18.26	3.59	37.91
Total food grains	Northern	24.19	24.29	26.12	24.56	25.36	24.57	23.75	23.67	24.24	24.42	23.67	37.62	44.17	27.48	0.92	28.43
	Central	30.23	29.93	29.11	28.90	28.98	28.99	28.97	29.22	29.62	29.95	29.35	23.99	21.61	28.76	-0.36	4.16
	Western	31.22	29.76	29.06	30.85	31.03	31.79	32.27	31.86	31.74	30.98	31.93	26.10	22.48	28.39	-0.68	5.98
	Southern	14.35	16.02	15.71	15.69	14.63	14.66	15.00	15.25	14.40	14.64	15.05	12.30	11.75	15.37	0.49	4.88

Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15)

5.2.1) Area under cultivation of major food grains crops

The percentage share of northern zone area under cultivation of crop rice was increased 39.90 to 52.85 percent during the period. The central zone percentage share of rice was decreased whereas in western and southern zone it was increased. The percentage share of rice was higher in northern zone is compared to central, western and southern zone. The low areas under cultivation of rice were in southern zone due to lack of irrigation facilities. The highest percentage share of area under cultivation of wheat was in western zone is compared to central, northern and southern zones. Area under cultivation of wheat was increased in northern, central and western zones, whereas in southern zone it was decreased. The areas percent share of bajra was decreased in northern and western zone; on the other hand it was increased in central and southern zone increased during the period 2001 to 2015. The higher percent share of bajra was in western zone is compared to southern, central and northern zone. Except southern zone in case of total cereal area of percent share was not much difference in other zone. The highest share was recorded in central zone is compared to western, northern and southern zone. Northern zone was having highest percent share under cultivation of crop maize, whereas lowest share in western zone. Percentage share of gram cultivation was highest in western zone and lowest in northern zone during the overall period. The percentage share of area under cultivation of total pulses was highest in western zone; it was followed by central, southern and northern zone respectively during the period. The area under cultivation of total food grain was lowest in southern zone during the period. There was not much difference between central and western zone during the overall period.

This study examined compound annual growth rate of cultivation area of major food grain production in Haryana zone wise during the period 2001 to 2015. Growth rate in rice cultivation was noted 0.35% in central zone during the period which was lowest in compared to other three zone. It was negative in central and southern zones. Wheat is an important crop

of Haryana state. It was noted negative growth in southern zone. It was 0.96 % in western zone whereas it was noted 0.64 % and 0.46 % by northern and central zone respectively. Growth rate in bajra noted negatively in northern and western zones with -0.90 % and -5.80% respectively. Growth of total cereals was negatively in southern zone with -4.86%. It was highest in southern zone 1.93% in western zone. Growth rate in maize was recorded negatively in northern zone It was 0% in case of crop maize in western zone. Growth rate in cultivation of crop gram was negatively in northern and western zone whereas it was positively in central and southern zone. Except northern and western zone growth in total pulses was recorded positively over the study. CAGR in area under cultivation of food grain was recorded positive in northern and southern zones in Haryana state. C.V showed variation in area under cultivation of crops. Highest variations in case of crop rice in southern and in crop wheat in southern zone over the period. In case bajra lowest variation in central zone,

5.2.2) Area under cash crops

The table 5.2.2 shows that percent share of each zone in area under cultivation of cash crops. The sugarcane area under cultivation shows that northern zone was highly dominated in cultivation over a period of time. Trend share of northern zone was highest in 2010-11.

Table 5.2.2 Area under cultivation of cash crops in Haryana (2001-2 to 2014-15)																	
Years / Crops	Zones	2001- 02	2002-03	2003- 04	2004- 05	2005-06	2006- 07	2007-08	2008- 09	2009- 10	2010-11	2011- 12	2012-13	2013-14	2014- 15	CAGR	C.V
Sugarcane	Northern	68.27	61.23	54.76	57.39	60.75	66.56	65.86	66.74	71.38	77.40	72.43	63.43	54.18	52.87	-1.81	21.04
	Central	19.32	26.92	30.74	30.69	31.05	25.08	25.60	24.82	20.00	16.29	21.07	28.64	23.24	18.11	-0.46	30.89
	Western	06.69	07.63	10.26	07.36	03.76	03.79	04.13	04.36	03.65	02.40	02.84	04.62	21.91	26.92	10.45	32.28
	southern	05.71	04.22	04.23	04.55	04.44	04.57	04.41	04.08	04.97	03.91	03.67	03.31	00.67	02.10	-6.89	24.40
Total Cotton	Northern	00.04	00.02	00.02	00.06	00.03	00.02	00.02	00.02	00.02	N.A	N.A	N.A	N.A	N.A	N.A	20.29
	Central	09.88	10.12	11.29	11.75	11.72	11.86	11.52	13.50	12.12	11.64	12.10	12.17	02.33	02.33	-9.81	09.01
	Western	89.49	89.28	87.52	86.27	84.72	85.38	87.09	85.89	87.39	88.00	87.61	87.61	19.18	19.18	-10.42	9.36
	southern	00.59	00.59	01.18	01.92	03.53	02.74	01.36	00.59	00.46	00.36	00.28	00.22	78.49	78.49	41.74	22.87
Rapeseeds & Mustard	Northern	01.30	01.33	01.23	01.00	01.03	01.17	01.29	01.29	01.56	01.65	01.53	01.65	01.68	02.66	5.26	28.09
	Central	10.84	09.97	09.60	12.81	01.58	13.53	12.09	12.09	11.12	10.63	09.63	10.63	08.70	09.31	-1.08	34.18
	Western	46.60	42.98	45.13	52.75	55.19	49.72	49.91	49.91	47.61	47.58	51.19	47.58	36.96	51.42	0.71	20.53
	Southern	41.27	45.72	44.04	33.45	42.20	35.58	36.72	36.72	39.72	40.15	37.65	40.15	52.66	36.61	-0.85	19.95
Total oilseeds	Northern	01.59	01.67	01.49	01.90	01.79	03.07	02.07	02.22	02.81	02.85	02.49	02.28	02.66	02.28	2.60	29.87
	Central	10.87	10.76	11.17	14.00	14.27	14.50	11.46	11.45	11.07	10.61	10.31	09.68	10.70	09.68	-0.82	30.665
	Western	46.33	46.59	53.53	51.56	50.03	49.34	55.99	55.65	46.63	47.07	46.99	53.82	53.06	53.82	1.08	22.87
	Southern	41.21	40.97	33.80	32.53	33.91	33.09	30.49	30.68	39.50	39.46	40.21	34.21	33.58	34.21	-1.32	21.86
Source: Department of Economic and Statistical Analysis , Government of Haryana (2001-15)																	

Except western zone area under cultivation of sugarcane was negative in other three zones. Western zone were having highest area in crop of total cotton over a period of time. Northern zone were having lowest area under cultivation, it was 0.24 percent over a period of time because this areas not more profitable of this crop. Trend share of northern zone during the period 2010-11 to 2014-15 not available. Percentage share area under rapeseed and mustard was increased in northern and southern zone. On the other hand in crop total oilseed increased northern and western zone respectively. CAGR in crop rapeseed & mustard and total oilseeds negatively in central and southern zone over the period. C.V shows variation in cash crops. Highest disparities in crop sugarcane, total cotton, rapeseed & mustard and total oilseed in western, southern and central zone respectively.

5.3) Production of various crops in Haryana

This section has attempted to examine the percent share of production of various crops in Haryana during the period .An attempt has been analysed the percent share of production zone-wise and compound average growth of selected various crops in Haryana state.

5.3.1) Production of food grains crops

The table 5.3.1 shows that production of crop rice was higher in northern zone are compared to other zones in Haryana. The share of western and southern zone was low is compared to northern and southern zone. Trend of production in central and western zone was increased whereas; in northern and southern zone was decreased during the period 2001 to 2015 Except southern zone there was not much disparity in production of wheat. Trend of wheat was also not much disparity in Haryana during the period 2001 to 2015.

Table 5.3.1 Production under cultivation of food grains crops in Haryana (2001-2 to 2014-15)																	
Years / Crops	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Rice	Northern	51.41	55.12	59.86	47.43	52.60	44.41	48.60	49.15	47.11	48.93	45.43	40.48	49.52	47.67	-0.54	22.65
	Central	30.21	16.02	22.92	30.72	28.08	27.03	27.83	28.93	27.52	29.60	30.10	36.13	30.01	33.61	0.76	23.18
	Western	14.57	13.42	15.14	17.99	16.47	13.69	20.46	18.37	21.58	17.45	20.20	21.75	19.30	17.33	1.25	24.57
	Southern	03.82	15.44	02.08	03.87	02.85	14.87	03.11	03.56	03.79	04.02	04.27	01.65	01.17	01.39	-6.96	52.23
Wheat	Northern	22.91	29.87	23.11	21.04	27.94	30.35	25.02	22.78	21.26	23.12	20.81	24.41	24.28	24.11	0.37	10.69
	Central	29.90	24.12	31.46	28.21	15.59	27.34	22.54	29.33	30.04	30.08	29.39	32.24	30.23	30.27	0.09	28.29
	Western	32.40	28.21	31.06	30.81	39.46	26.57	38.46	33.95	35.40	32.95	36.02	36.54	38.04	38.58	1.25	23.11
	Southern	14.79	17.80	14.37	19.94	17.01	15.73	13.98	13.94	13.31	13.84	13.77	06.80	07.45	07.05	-5.16	22.76
Bajra	Northern	00.61	00.32	00.87	00.80	01.55	01.02	01.18	00.87	01.41	00.65	00.51	00.54	00.82	00.93	3.09	48.27
	Central	21.19	19.00	22.71	17.69	24.15	22.40	22.43	25.43	19.72	23.44	20.17	18.87	22.37	09.87	-5.31	28.27
	Western	37.65	57.49	49.13	40.66	49.69	42.61	42.12	39.01	38.78	32.26	41.79	37.47	26.33	24.93	-2.90	26.90
	Southern	40.55	23.19	27.29	40.85	24.61	33.97	34.28	34.69	40.09	43.66	37.53	43.13	50.48	64.27	3.34	38.09
Total cereals	Northern	27.77	27.14	28.26	26.97	29.24	22.91	27.33	27.18	24.77	27.73	24.36	27.87	24.75	28.50	0.19	13.47
	Central	28.89	29.34	30.36	28.69	28.47	33.36	29.18	28.67	28.85	29.44	28.81	31.09	25.11	26.06	-0.73	11.82
	Western	29.27	27.55	28.87	29.99	29.61	30.74	31.46	30.53	33.18	29.47	33.27	32.99	27.70	24.74	-1.19	16.93
	Southern	14.06	15.97	12.51	14.34	12.68	12.99	12.03	13.62	13.19	13.36	13.55	08.06	22.44	20.69	2.80	32.94
Maize	Northern	94.12	93.62	93.10	90.24	94.87	94.44	80.00	91.89	95.83	84.62	78.95	78.95	78.95	80.00	0.43	35.58
	Central	N.A	N.A	N.A	09.76	05.13	05.56	N.A	08.11	03.33	15.38	21.05	21.05	21.05	22.4	N.A	9.27
	Western	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
	Southern	05.88	06.38	06.90	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	34.69
Gram	Northern	02.56	00.79	02.44	01.00	01.10	01.39	N.A	N.A	00.83	N.A	N.A	00.73	00.63	01.08	-6.02	36.9

Contd..2

	Central	03.85	05.56	12.20	05.00	02.20	05.56	03.33	03.70	02.48	02.78	01.82	01.04	01.81	02.15	-4.07	53.13
	Western	80.77	80.16	68.29	74.00	90.11	86.11	85.56	25.93	85.95	79.17	86.36	88.82	85.82	81.72	0.08	37.84
	Southern	12.82	13.49	17.07	20.00	06.59	06.94	11.11	70.37	10.74	18.06	11.82	09.40	11.74	15.05	1.15	63.35
Total pulses	Northern	08.92	05.89	06.49	05.10	04.69	05.46	04.22	04.19	04.01	05.45	04.16	04.98	05.45	07.12	-1.60	24.80
	Central	12.63	12.25	14.47	20.82	26.16	22.00	21.60	28.12	32.30	20.76	17.24	13.89	20.76	11.24	-0.83	42.66
	Western	64.83	70.21	60.03	55.56	61.97	62.70	63.46	55.43	53.00	66.91	63.13	71.65	66.91	63.30	-0.17	1726
	Southern	13.63	11.65	19.02	18.52	07.18	9.84	10.72	12.26	10.69	06.89	15.47	09.48	06.89	18.35	2.15	32.66
Total food grains	Northern	27.36	21.78	21.57	24.56	30.39	29.73	N.A	27.66	24.83	26.14	24.17	14.66	29.18	26.10	-0.34	30.33
	Central	29.20	32.40	31.67	28.90	12.64	30.24	N.A	29.47	28.62	29.97	28.66	36.43	29.93	27.57	-0.41	32.05
	Western	29.52	31.15	31.70	30.85	48.55	28.24	N.A	29.54	33.44	30.30	33.64	39.42	32.89	38.66	1.95	29.11
	Southern	13.92	14.67	15.06	15.69	08.42	11.79	N.A	13.33	13.10	13.58	13.53	09.49	07.99	07.68	-4.16	28.98
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15) N.A : not available																	

Production of bajra was lowest Northern zone. But the trend of production of bajra was increased during the period except central zone. Except southern zone, there was not much disparity in trend of crop total cereal. Trend share of total cereal in central and western zone were decreased, whereas in northern and southern were increased. There was more disparity in of production crop maize. Because production of northern zone was highest whereas production of northern zones was very low during the period. Production of crop maize in western and southern zone was not available. Out of the total production of gram western zone was produced more over a period of time; it was followed by southern and central zone. But northern zone was produced very low over a period of time. In northern and central zone, it was decreased. There was much disparity in trend of total pulses except northern zone. Western zone was produced more over a period of time. Trend share of southern zone was increased during the period. There was not much disparity in trend of total food grain production.

This study found growth rate of rice production positively in central and southern zone of Haryana state. Growth rate of wheat production was negative in southern zone. Growth rate of bajra was highest in southern zone. It was positively in northern and southern zone of Haryana state. Growth rate of total production in total cereal was higher in southern zone, whereas lowest in northern zone. It was negative in central and western zone. Growth rate of cop gram production was positive in western and southern zone, whereas it was negative in northern and central zone. Growth rate of total pulses was negative except southern zone during the period. Western zone was produced more total food grain production with 1.95 % growth rate.

Table 5.3.2 Production under cultivation of cash crops in Haryana (2001-2 to 2014-15)

Years / Crops	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Sugarcane	Northern	66.22	56.09	59.25	63.26	63.34	68.68	66.46	65.76	70.71	79.23	72.52	67.27	64.38	66.74	0.06	17.20
	Central	23.38	30.70	26.85	26.82	17.82	24.29	27.08	26.08	20.81	15.67	22.02	25.79	28.49	27.58	1.19	32.87
	Western	6.00	8.42	10.14	6.48	12.15	3.45	3.65	4.20	3.47	2.29	2.65	3.34	2.88	2.18	-6.97	40.57
	Southern	4.41	4.79	3.76	3.44	6.70	3.58	2.81	3.97	5.01	2.82	2.81	3.60	4.24	3.50	-1.63	36.11
Total cotton	Northern	N.A	N.A	N.A	N.A	N.A	N.A	NA	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
	Central	7.09	13.80	7.51	10.38	9.40	11.45	9.91	9.61	9.91	9.12	10.82	10.13	10.82	9.61	2.20	31.52
	Western	92.41	85.11	91.71	87.49	87.90	87.02	89.29	90.12	89.88	90.72	88.78	89.46	88.78	90.12	-0.18	24.95
	Southern	0.51	1.09	0.77	2.13	2.70	1.53	0.80	0.27	0.22	0.16	0.40	0.41	0.40	0.27	-4.43	37.68
Rape seed \$mustrad	Northern	0.89	0.76	0.75	0.62	1.24	1.14	2.09	1.17	1.79	1.78	1.68	1.78	1.69	2.02	6.02	45.11
	Central	11.25	10.11	10.25	12.44	19.57	11.87	12.57	11.22	11.19	10.06	9.02	10.06	9.82	7.08	-3.25	20.67
	Western	44.11	46.40	47.13	52.44	32.76	47.35	52.36	43.05	43.51	48.28	50.68	48.28	40.09	39.15	-0.85	24.33
	Southern	43.75	42.73	41.88	34.51	46.43	39.65	32.98	44.56	43.51	39.88	38.61	39.88	48.40	51.75	1.21	14.06
Total oilseeds	Northern	1.08	1.21	1.41	1.79	2.05	4.16	2.72	3.77	3.12	3.28	2.46	1.97	1.95	2.05	4.64	45.13
	Central	11.30	7.78	12.40	2.30	15.11	11.48	11.73	10.90	11.00	9.86	8.92	11.00	8.17	15.11	2.10	32.57
	Western	44.02	47.38	51.05	57.87	46.96	46.03	49.18	42.03	43.14	47.69	50.44	54.84	52.07	46.96	0.46	19.60
	Southern	43.59	43.63	35.14	38.04	35.89	38.33	36.37	43.30	42.74	39.16	38.18	32.19	37.81	35.89	-1.38	16.76

Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)**N A: not available**

Highest variation in production crop rice, total cereal and gram in southern zone whereas in bajra and maize in northern zone during the period. In production crops, wheat, total pulses and total food grains highest variations in central zone over the study.

5.3.2) Production of cash crops in Haryana

The table 5.3.2 shows that production of cash crop in Haryana zone wise. Northern zone have highest production in case of crop sugarcane whereas it was lowest in southern zone during the period. But the percent of sugarcane production in northern zone was increasing. Central zone have produced higher share in total cotton during the period of time. Northern zone did not produce this crop during the same period. This study found growth rate of cash crop production in Haryana state. Growth rate of Sugarcane production was recorded positively in northern and central zones with 0.06 percent and 1.19 percent respectively. Growth rate of production total cotton was not recorded in northern zone over a period. It was highest in central zone with 2.20 percent. There was recorded positive growth in crop rapeseed and mustard production in northern and southern zones with 6.02 percent and 1.21 percent respectively. There was noted positive growth in crop total oilseeds production in northern, central and western zones with 1.64, 2.10 and 0.46 percent respectively. In this table CV shows variations in cash crops. Highest variations in crop sugarcane in western and in crop total cotton in southern zone over the period. Highest variations in crop rapeseed & mustard and total oilseeds in northern zone.

5.4) Productivity of various crops

An attempt has been made to examine average productivity of selected food grains and cash crops during the period (2001 to 2015).

Table 5.4.1 Productivity under cultivation of food grain crops in Haryana (in kilogram/ hectare)																	
Years/ Crops	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Rice	Northern	364.23	424.74	359.63	250.87	327.81	322.57	393.89	358.62	343.12	334.46	294.21	104.67	103.69	74.69	-10.70	39.26
	Central	207.12	110.29	207.13	233.94	259.33	273.32	276.68	290.82	212.00	233.58	238.89	81.75	85.46	86.34	-6.06	38.06
	Western	275.79	284.67	290.92	331.91	340.85	301.72	429.61	383.20	331.16	308.78	325.58	97.16	102.34	75.79	-8.81	32.04
	Southern	274.67	135.90	266.67	274.73	254.29	407.41	279.79	313.87	259.88	276.52	261.02	102.20	119.65	9329	-7.42	42.34
Wheat	Northern	429.85	301.63	409.26	383.56	386.86	414.96	429.03	433.92	432.02	432.50	432.96	111.67	104.23	100.91	-9.83	38.87
	Central	415.25	250.14	519.04	394.70	224.37	386.64	284.92	413.87	468.94	430.36	460.46	124.62	111.31	161.61	-6.52	41.09
	Western	407.41	280.64	394.25	399.71	391.59	259.78	443.26	409.91	479.15	462.77	486.82	122.36	178.14	109.83	-8.94	37.87
	Southern	382.05	377.36	391.16	554.22	378.08	359.68	365.90	406.38	451.88	418.32	457.57	119.52	116.31	125.05	-7.67	38.34
Bajra	Northern	71.43	42.55	108.11	250.00	142.86	184.21	279.07	204.08	283.02	146.34	171.43	198.11	79.44	61.43	-1.07	50.20
	Central	140.26	119.80	108.33	166.82	151.75	161.22	186.03	228.08	169.63	179.72	176.73	111.78	111.47	95.00	-2.74	25.07
	Western	90.88	128.65	83.46	146.39	100.00	289.84	182.98	176.17	165.20	131.23	156.67	165.20	45.28	85.62	-0.42	43.01
	Southern	114.75	59.63	86.57	174.74	61.39	105.07	154.46	176.03	182.63	175.00	175.14	297.50	166.55	113.39	-0.09	42.87
Total cereal	Northern	357.79	359.03	351.44	338.43	356.81	255.64	386.65	395.49	365.39	382.42	361.64	102.40	149.59	93.53	-9.14	35.53
	Central	301.28	316.96	321.77	309.27	307.81	320.91	339.84	342.23	343.11	338.10	347.39	111.47	105.36	102.22	-7.43	33.95
	Western	345.74	328.77	304.95	329.16	322.76	291.53	369.88	355.95	394.95	340.97	398.82	122.37	116.96	107.82	-7.99	34.48
	Southern	264.96	328.41	283.02	283.68	272.64	249.59	273.05	315.08	324.78	309.25	323.16	119.13	123.90	118.35	-5.59	30.24
Maize	Northern	226.95	269.94	186.21	245.03	251.70	207.32	157.48	265.63	198.28	224.49	182.93	78.77	108.28	116.16	-4.67	31.04
	Central	110.11	200.00	266.67	333.33	250.00	250.00	400.00	375.00	160.00	173.91	333.33	64.00	69.57	83.33	-2.03	32.15
	Western	250..00	230.12	172.00	211.00	100.00	100.00	200.00	140.00	190.00	200.10	250.00	N.A	N.A	N.A	N.A	28.64

Contd..2

Gram	Southern	250.00	233.33	222.22	200.00	150.00	170.00	190.40	220.00	180.18	150.00	250.00	N.A	N.A	N.A	N.A	28.6
	Northern	100.00	71.43	58.82	83.33	71.43	76.92	76.64	74.43	45.45	46.78	54.34	63.64	60.81	70.90	-2.43	21.46
	Central	187.50	90.91	96.15	113.64	166.67	200.00	125.00	100.00	136.36	105.26	111.11	81.82	52.63	88.89	-5.19	35.17
	Western	58.82	86.40	71.07	77.89	85.15	53.77	80.97	55.01	96.30	73.64	97.34	113.09	136.95	120.22	5.24	28.68
	Southern	107.53	103.03	83.33	92.59	90.91	54.35	116.28	142.34	104.84	109.52	112.07	115.32	201.52	96.38	-0.78	30.27
Total pulses	Northern	77.39	77.19	76.99	69.52	74.73	67.03	58.76	49.41	67.71	61.63	70.15	90.61	91.94	119.38	3.14	22.69
	Central	84.00	87.56	74.90	82.09	139.34	83.11	107.75	106.02	176.69	109.78	107.73	126.81	132.10	99.99	1.25	25.69
	Western	57.26	78.69	61.69	60.83	72.89	52.12	72.96	48.22	95.23	68.24	84.59	130.65	130.93	115.94	5.17	34.26
	Southern	77.71	72.50	96.23	84.39	64.60	49.77	97.32	56.94	94.02	72.83	92.11	145.55	146.31	94.65	1.42	31.98
Total food grains	Northern	356.04	259.30	227.56	100.00	353.95	364.93	365.10	390.90	358.72	353.05	359.88	101.35	96.74	98.57	-8.77	44.54
	Central	304.04	313.10	299.76	100.00	128.80	314.76	234.90	337.41	338.34	330.07	344.22	262.69	104.86	146.54	-5.08	36.73
	Western	297.59	302.69	300.61	100.00	462.08	268.03	274.70	310.10	368.82	322.59	371.25	79.82	120.35	135.15	-5.48	43.03
	Southern	305.35	264.73	264.33	100.00	169.95	242.60	234.90	292.27	318.53	305.94	316.95	187.43	126.11	134.93	-5.67	32.64

Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15)

N.A : not available.

5.4.1) Productivity of food grain crops

The table 5.4.1 shows that the average productivity of major food grains crops in overall period. Northern zone was recorded higher average yield of crop rice. It was 4057.21 kg/ha over a period of time. It was followed by western, southern and central zone with 3879.48, 3268.09 and 2796.65 kg/ha over a period of time. Trend share of average productivity of crop rice was decreasing. Trend share of average productivity of crop wheat was increased in all zones during the period in all zones. Highest variation in rice in southern zone. Productivity of crops maize and gram shows highest variation in central zone, whereas in crops wheat, bajra, and total cereal in northern zone. In case of crop total pulses and total food grain productivity is highest in western zone.

5.4.2) Productivity of cash crops

The table 5.4.2 shows that the average product of cash crops. Productivity in cash of crop sugarcane was decreased in all zone of Haryana. Productivity In case of crop cotton was decreased in all three zones except northern zone. In northern zone was not recorded. Except southern zone rapeseed & mustard was increased in other three zones. Except southern zone total oilseed was also increased in other three zones. CAGR of sugarcane was negative in all zones of Haryana. CAGR was negative in only southern zone in case of crop rapeseed and mustard and total oilseed. Highest variations in productivity of crops sugarcane and total cotton in northern and southern zone respectively. Productivity of crops rapeseed & mustard and total oilseed in western zone respectively.

Table 5.4.2 Productivity under cultivation of cash crops in Haryana (in kilogram/ hectare)

Years / Crops	Zones	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	CAGR	C.V
Sugarcane	Northern	595.81	438.70	609.66	679.35	690.59	647.67	688.98	621.65	568.11	734.09	715.69	91.51	82.26	113.34	-11.18	46.43
	Central	743.19	546.08	492.25	538.62	380.15	608.02	722.22	662.82	596.69	689.92	747.19	123.06	156.96	113.47	-12.56	44.95
	Western	550.56	528.46	556.70	542.37	214.00	571.43	603.45	606.56	545.45	685.21	666.67	111.83	254.89	119.91	-10.32	42.81
	Southern	473.68	544.12	500.00	465.75	100.00	491.53	435.48	614.04	577.78	516.13	548.39	131.84	577.78	105.01	-10.20	41.72
Total cotton	Northern	N.A	N.A	N.A	N.A	N.A	N.A	NA	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
	Central	178.51	158.56	133.33	236.25	267.86	250.00	286.18	269.17	332.73	297.62	316.58	113.94	124.22	119.05	-2.85	36.04
	Western	257.14	110.87	209.88	271.26	346.57	263.83	340.95	396.69	418.72	391.45	358.86	146.24	120.82	148.37	-3.85	40.19
	Southern	212.12	216.22	131.15	297.03	255.71	144.65	194.44	172.41	190.48	166.67	500.00	58.05	74.49	115.22	-4.27	56.11
Rapeseed & Mustard	Northern	94.34	93.75	96.77	96.77	109.59	111.11	207.79	90.91	197.53	178.57	205.13	93.94	180.25	160.71	3.88	34.97
	Central	142.21	166.67	170.12	151.32	125.00	100.21	132.78	92.67	173.01	156.83	175.15	61.24	15.38	156.49	0.69	36.38
	Western	129.66	177.38	166.37	154.93	53.96	108.79	134.00	86.10	157.17	168.11	185.13	55.57	291.25	154.53	1.26	41.57
	Southern	145.23	153.57	151.52	160.79	100.00	127.28	114.75	121.13	188.38	164.55	191.77	75.33	188.38	129.28	-0.83	24.10
Total oilseeds	Northern	92.42	103.30	108.79	128.69	133.59	148.05	148.67	145.63	191.89	189.93	197.50	113.16	143.64	128.29	2.37	23.11
	Central	141.33	103.07	127.96	22.44	123.82	86.53	115.75	81.80	171.75	153.15	173.59	364.44	138.70	177.00	1.62	24.19
	Western	129.14	144.97	109.93	153.11	109.79	101.97	99.34	64.85	159.84	166.98	215.35	42.36	145.58	163.76	1.71	34.74
	Southern	143.79	151.82	119.85	159.49	123.81	126.60	134.91	121.24	186.95	163.57	190.49	76.02	150.99	129.20	-0.76	20.93

Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15)**NA: not available**

5.5 District-Wise Studies

Table 5.5.1 : District-wise CAGR (Area under cultivation of food-grains crops) in Haryana						
Districts	Rice	Wheat	Bajra	Total Cereal	Total Pulses	Total Food Grains
Ambala	0.71	0.65	-1.58	-2.03	-4.32	0.43
Panchkula	3.32	0.21	6.37	0.70	-4.48	0.32
Yamunanagar	1.60	2.31	0.10	1.83	-3.23	1.72
Kurukshetra	0.38	0.18	0.10	0.26	-1.02	0.27
Kaithal	-0.28	0.89	0.81	0.26	-4.92	0.26
Karnal	0.17	0.22	-4.11	0.14	-0.14	0.11
Panipat	-0.19	0.26	-3.58	0.02	-0.14	0.01
Sonipat	1.16	0.18	0.19	0.68	-6.24	0.65
Rohtak	3.64	2.06	-0.47	0.81	-1.18	0.67
Jhajjar	4.51	0.21	0.37	-0.19	0.64	3.05
Faridabad	-3.55	-4.61	-7.45	-2.09	-7.58	-9.84
Gurgaon	-3.08	-3.87	-4.97	-6.70	-5.50	-6.73
Rewari	3.89	-1.44	0.69	-0.45	4.85	-0.28
Mahendragarh	N.A	-0.42	-0.66	-0.58	-2.59	-2.25
Bhiwani	5.17	1.08	-5.82	-1.69	2.40	-0.20
Jind	0.50	0.35	-4.88	-0.18	-0.93	0.18
Hisar	2.21	0.61	-4.71	-0.18	2.92	0.15
Fatehabad	2.95	0.62	-3.45	0.97	-3.17	0.92
Sirsa	3.97	0.11	0.78	1.43	-4.63	1.34
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15) N.A : not available						

The table 5.5.1 shows district-wise CAGR in area under cultivation of food-grains crops. CAGR in area under rice cultivation was negative in Kaithal, Panipat, Faridabad and Gurgaon with -2.8, -0.19, -3.55 and -3.08 respectively. It was highest in Bhiwani with 5.17 and lowest in Ambala with 0.75 during the period. There are not much difference between Yamunanagar and Sonipat. CAGR in area under wheat cultivation negative in Faridabad,

Gurgaon, Rewari and Mahendergarh. It was highest in Rohtak and Yamunanagar .There is not much disparity in Panchkula, Karnal, Panipat and Jhajjar with 6.37, 0.81, 0.19 and 0.37. CAGR in area under bajra cultivation positively in Panchkula, Kathial, Sonipat and Jhajjar with 6.37, 0.81, 0.19 and 0.37 respectively. CAGR in area under cultivation total oilseed negative in Ambala, Jhajjar, Faridabad, Gurgaon, Rewari, Mehendergarh, Bhiwani, Jind and Hisar. Highest positive growth in Yamunanagar with 1.83. CAGR in area under total pulses positive in Jhajjar, Rewari, Bhiwani and Hisar with 0.64, 4.85, 2.40 and 2.92 respectively over the period of time. CAGR in area under total food grains crop negative in Rewari, and Mahendergarh. It was highest in Faridabad and lowest in Panchkula with 0.32.

Table 5.5.2 : District-wise CAGR (Area under cultivation of cash crops) in Haryana			
Districts	Sugarcane	Total Oilseeds	Rapeseed & Mustrad
Ambala	00.54	-02.32	08.61
Panchkula	-09.02	-01.98	01.97
Yamunanagar	04.58	07.17	08.61
Kurukshatra	-09.72	18.42	01.97
Kaithal	02.69	-09.86	-04.25
Karnal	-00.93	00.08	01.97
Panipat	02.69	01.51	01.97
Sonipat	-06.10	-03.81	-02.29
Rohtak	-01.08	01.37	-00.24
Jhajjar	01.09	00.50	-02.20
Faridabad	-19.19	-12.34	-13.35
Gurgaon	16.19	-09.14	-10.81
Rewari	-19.19	00.46	-02.02
Mahendergarh	23.75	00.45	01.10
Bhiwani	-19.19	01.41	01.02
Jind	10.77	-18.41	01.00
Hisar	-21.33	06.35	06.01
Fatehabad	02.65	-01.39	-02.90
Sirsa	-18.38	00.86	00.08
Source: Department of Economic and Statistical Analysis , Government of Haryana (2001-15) N.A : not available			

The table 5.5.2 shows that district-wise CAGR area under cultivation of cash crops. CAGR area under cultivation of sugarcane is negative in all districts except kaithal, Jhajjar, Gurgaon, Mahendergarh, Jind and Fatehabad. CAGR area under cultivation Oilseed is higher in Kurukshatra with 18.42 and lowest in Karnal with 0.08. It was negative in Ambala, Panchkula, Kaithal, Sonipat, Faridabad, Gurgaon, Jind and Fatehabad. CAGR area under cultivation of R&M is highest in Ambala and Yamunanagar with 8.61 whereas lowest in Sirsa with 0.08. It is negative in Kaithal, Sonipat, Rohtak, Jhajjar, Faridabad, Gurgaon, Rewari and Fatehabad.

Table 5.5.3 : CAGR (Production under cultivation of food-grain crops)						
Districts	Rice	Wheat	Bajra	Total Cereal	Total Pulses	Total Food Grains
Ambala	2.53	2.68	2.08	2.49	-9.55	-3.74
Panchkula	5.48	2.12	2.08	2.68	-15.98	-9.01
Yamunanagar	3.17	3.75	5.08	3.86	-6.34	-8.07
Kurukshatra	2.14	0.54	5.08	3.98	-4.83	-4.39
Kaithal	2.06	1.42	7.63	3.34	-7.15	2.30
Karnal	1.80	0.68	3.72	1.93	-10.33	-3.23
Panipat	0.19	0.53	5.08	-2.84	-6.15	-1.58
Sonipat	4.28	1.26	2.94	3.50	-3.67	-0.49
Rohtak	6.24	0.92	-2.12	-2.12	2.81	-6.58
Jhajjar	8.06	0.68	4.45	2.50	1.01	-5.10
Faridabad	-6.99	-9.18	-6.88	-3.81	-24.69	-6.93
Gurgaon	-1.58	-5.59	-1.19	-4.59	-9.02	-7.97
Rewari	8.16	-0.19	6.35	1.54	-2.06	0.00
Mahendergarh	N.A	1.72	5.11	3.14	0.35	-0.47
Bhiwani	4.08	2.89	-0.82	2.41	-0.84	-5.31
Jind	2.74	0.73	-4.42	0.94	-5.25	0.68
Hisar	4.83	0.95	4.71	0.96	14.25	-3.67
Fatehabad	4.24	2.04	0.00	2.39	-5.32	-7.06
Sirsa	6.65	2.95	0.00	3.36	2.75	-6.60
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15)						
N.A: not available						

The table 5.5.3 shows CAGR (Production under cultivation of food-grain crops). Growth of production under rice cultivation in Rewari with 8.16 percent whereas lowest in Panipat with 0.19 percent. It was negative in Faridabad and Gurgaon. Growth of Production under wheat cultivation negative in Faridabad Gorgon and Rewari with -9.18, -5.59 and -0.19. It was higher in Yamunanagar whereas lowest in Panipat. Growth of Production under bajra was higher in Kaithal with 7.63 and lowest in sirsa. Growth of production under total cereal cultivation was negative in Panipat, Rohtak, Faridabad and Gurgaon with -2.84, -2.12, -3.81 and -4.59 respectively. Growth of production in crop total pulses positives in Rohtak, Jhajjar, Mahendergarh and Sirsa. Growth of production under total food grain production is positive in Kaithal, Rewari and Jind. It was highest in Kaithal.

Table 5.5.4 District- wise CAGR (Production under cultivation of cash crops) in Haryana			
Districts	Sugarcane	Total Oilseeds	Rapeseed & Mustard
Ambala	-1.83	1.96	5.08
Panchkula	0.84	6.76	5.08
Yamunanagar	-1.99	10.24	8.16
Kurukshatra	-0.95	14.05	5.08
Kaithal	1.14	-1.86	0.00
Karnal	3.10	4.36	5.08
Panipat	3.81	5.08	5.08
Sonipat	-1.90	-2.03	-2.03
Rohtak	0.44	1.40	1.40
Jhajjar	-7.17	1.71	1.68
Faridabad	-5.37	-7.66	-7.55
Gurgaon	-1.78	-5.70	-5.73
Rewari	N.A	1.72	1.71
Mahendergarh	N.A	3.39	3.39
Bhiwani	0.00	4.21	5.38
Jind	-1.22	2.43	2.43
Hisar	-7.30	6.58	6.56
Fatehabad	-4.83	2.33	1.44
Sirsa	1.11	3.05	2.79
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15) N.A: not available			

The table 5.5.4 shows district- wise CAGR production under cultivation of cash crops. Production under cultivation of cash crops sugarcane was not recorded in Rewari and Mahendergarh. It was positive in Panchkula, Kaithal, Karnal, Panipat, Rohtak, Bhiwani and Rohtak. CAGR production under total oilseed negative in Kaithal, Sonipat, Faridabad and Gurgaon. CAGR production under Rapeseed and Mustard was negative in Faridabad and Gurgaon. There are not much disparities in Ambala, Panchkula, Kurukshetra, Kaithal, Karnal and Bhiwani.

Table 5.5.5 District- wise CAGR (Productivity of food-grains crops) in Haryana						
Districts	Rice	Wheat	Bajra	Total Cereals	Total Pulses	Total Food Grains
Ambala	-0.56	2.01	6.76	4.63	-9.55	-3.74
Panchkula	-1.34	1.90	-1.39	1.97	-15.98	-9.01
Yamunanagar	-2.59	1.40	5.08	1.99	-6.34	-8.07
Kurukshetra	2.56	0.37	5.08	3.71	-4.83	-4.39
Kaithal	6.03	0.53	6.70	3.07	-7.15	2.30
Karnal	5.00	0.45	8.16	1.79	-10.33	-3.23
Panipat	-1.44	0.27	8.98	-2.86	-6.15	-1.58
Sonipat	1.20	1.08	2.75	2.80	-3.67	-0.49
Rohtak	-2.12	-1.12	-1.66	-2.90	2.81	-6.58
Jhajjar	-3.37	0.47	4.06	2.70	1.01	-5.10
Faridabad	4.02	-4.47	0.62	-1.75	-24.69	-6.93
Gurgaon	0.11	-1.78	3.98	2.26	-9.02	-7.97
Rewari	-6.72	1.27	5.64	2.10	-2.06	0.00
Mahendergarh	N.A	2.14	5.81	3.75	0.35	-0.47
Bhiwani	-5.25	1.79	5.30	4.17	-0.84	-5.31
Jind	3.04	0.38	0.49	1.13	-5.25	0.68
Hisar	-5.18	0.33	8.89	1.14	14.25	-3.67
Fatehabad	-2.22	1.42	3.57	1.41	-5.32	-7.06
Sirsa	-3.95	1.82	0.78	1.91	2.75	-6.60
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-2015)						

The table 5.5.5 shows that district- wise CAGR (productivity of food-grains crops). CAGR under case of crop rice productivity positive in Kurukshetra, Kaithal, Karnal, Sonipat, Faridabad, Gurgaon and Jind with 2.56, 6.03, 5.1, 1.20 and 0.11 respectively over the period.

CAGR under case of crop wheat productivity negative in Rohtak, Faridabad, Gurgaon with -1.12, -4.47 and -1.78 respectively over the period of time. Productivity under bajra cultivation focused negative in Panchkula and Rohtak with -1.39 and -1.66 respectively. It was highest in Panipat with 8.98, whereas lowest in Jind 0.49. Productivity under total cereal cultivation observed negative in Panipat, Sonipat, Rohtak, Jhajjar and Faridabad with -2.86, -2.90 and -1.75. It was highest in Bhiwani with 4.17 and lowest in Jind with 1.13. Productivity under total pulses cultivation recorded positive in Rohtak, Jhajjar, Mahendragarh, Hisar and Sirsa with 2.81, 0.01, 0.35, 14.25 and 2.75 respectively. CAGR under productivity of total food grain is positive in Rewari and Jind with 0.01 and 0.68.

Table 5.5.6 CAGR (Productivity of cash crops) in Haryana			
Districts	Sugarcane	Total Oilseeds	Rapeseeds & Mustard
Ambala	1.03	4.76	3.12
Panchkula	4.29	6.30	1.17
Yamunanagar	1.37	3.26	1.03
Kurukshetra	1.41	-2.39	0.76
Kaithal	2.73	5.83	7.79
Karnal	1.71	2.43	3.72
Panipat	0.95	3.21	5.87
Sonipat	-1.73	1.24	1.97
Rohtak	4.18	0.95	2.77
Jhajjar	-8.89	-0.29	3.07
Faridabad	13.23	5.13	-4.11
Gurgaon	3.21	0.51	-0.74
Rewari	N.A	0.30	4.49
Mahendragarh	N.A	2.54	3.89
Bhiwani	-5.42	1.64	4.17
Jind	3.69	1.45	3.72
Hisar	4.00	1.15	3.56
Fatehabad	14.76	1.12	4.61
Sirsa	14.18	1.51	4.01
Source: Department of Economic and Statistical Analysis, Government of Haryana (2001-15) N.A : not available			

The table 5.5.6 shows CAGR productivity of cash crops. Productivity under sugarcane is negative in Sonipat, Jhajjar and Bhiwani with -1.73, -8.89 and -5.42. It was highest in Fatehabad with 14.76. Rewari and Mahendergarh districts have not available. There are not much disparities in Fatehabad and Sirsa districts. Productivity under total oilseed negative in Kurukshetra and Jhajjar with -2.39 and -0.29. It was highest in Kaithal with 5.83 and lowest in Rewari with 0.30. There are no disparities in Sonipat, Bhiwani, Jind, Hisar, Fatehabad and Sirsa. CAGR productivity under cultivation of rapeseed & mustard highest in Kaithal with 7.79. It was followed by Panipat, Fatehabad, Rewari, Bhiwani, Sirsa, Mahendergarh with 5.87, 4.61, 4.49, 4.01 and 3.89 per cent respectively during the period. Negative CAGR under cultivation of rapeseed & mustard in Faridabad and Gurgaon with -4.11 and -0.74 per cent respectively.

5.6) σ -convergence zone wise

This study deals with σ -convergence of dispersion of area, production and productivity across the districts over time. This model is based on calculating the standard deviation (S.D) across four zone and nineteen districts of Haryana for each year starting from 2000-01 to 2014-15. As the σ -convergence measures the inter-regional inequality, it may very well infer that the inter-regional inequality among the districts have increased during given time period. When the dispersion of area, production and productivity across districts falls over time, there is σ -convergence. The model is

$$SD_t = \eta + \tau t + \omega_t$$

There, SD = Standard Deviation (Area, Production and Productivity)

η = Intercept, τ = Slope coefficient, ω = Error term, t = time (2001-02 to 2014-2015)

Table 5.6.1: σ –convergence for Area, Production and Productivity of food-grain crops in Haryana zone-wise			
	Intercept	Growth coefficient	R ²
Area	285.03(0.000)	5.00(0.000)	0.62
Production	836.17(0.000)	48.34(0.000)	0.81
Productivity	43.92(0.000)	-1.28(0.000)	0.44
Source: Researcher Calculation			

The table 5.6.1 shows that zones of Haryana have exhibited not significant sigma convergence in area and productivity in food grain crops. Higher sigma convergence in production comparison to area and productivity. Growth coefficient is positive in area and production and not negative in productivity.

Table 5.6.2 : σ –convergence for Area, Production and Productivity of cash crops in Haryana zone-wise			
	Intercept	Growth coefficient	R ²
Area	44.34(0.000)	-1.15(0.000)	0.91
Production	254.65(0.000)	-3.41(0.000)	0.53
Productivity	78.43(0.000)	-0.65(0.000)	0.43
Source: Researcher Calculation			

The table 5.6.2 shows that zones of Haryana have exhibited not significant sigma convergence in productivity in cash crops. Higher σ -convergence in area comparison to production and productivity. Growth coefficient is negatively in cash crops in areas, production and productivity.

Figure 5.1 Standard Deviation of area under cultivation of food grains crops zone-wise Haryana during 2001-2015

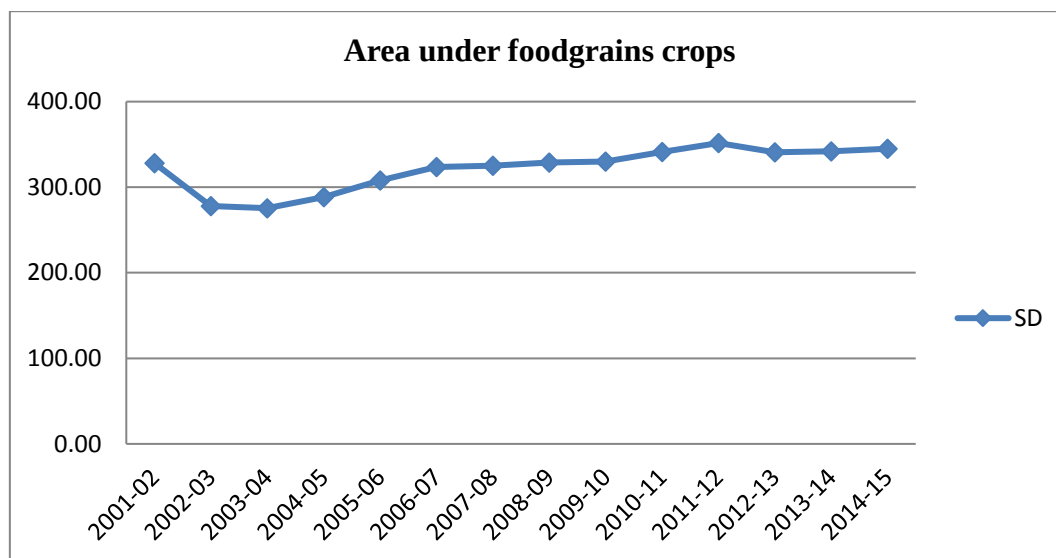


Figure 5.1 shows Standard deviation of area under food grains crops across 4 zones in Haryana during 2001-2015. S.D is increased over the time period there is σ -divergence in area of food grain crops.

Figure 5.2 Standard Deviation of area under cultivation of cash crops zone-wise in Haryana during 2001-2015

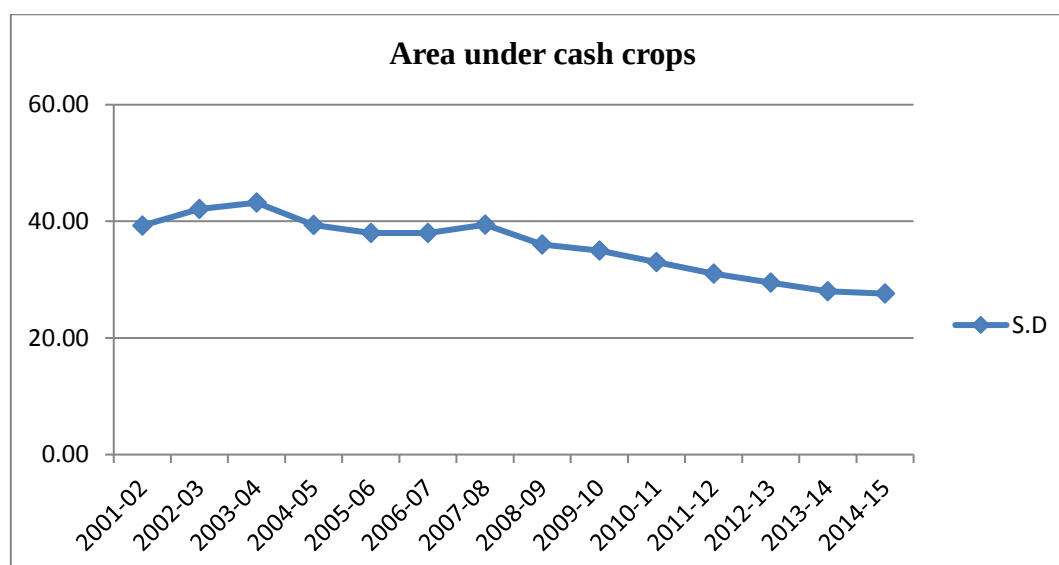


Figure 5.2 shows Standard deviation of area under cash crops across 4 zones in Haryana during 2001-2015. S.D is decreased over the time period there is σ -convergence in area of cash crops.

Figure 5.3 Standard Deviation of production under cultivation of food grain crops across districts of Haryana during 2001-2015

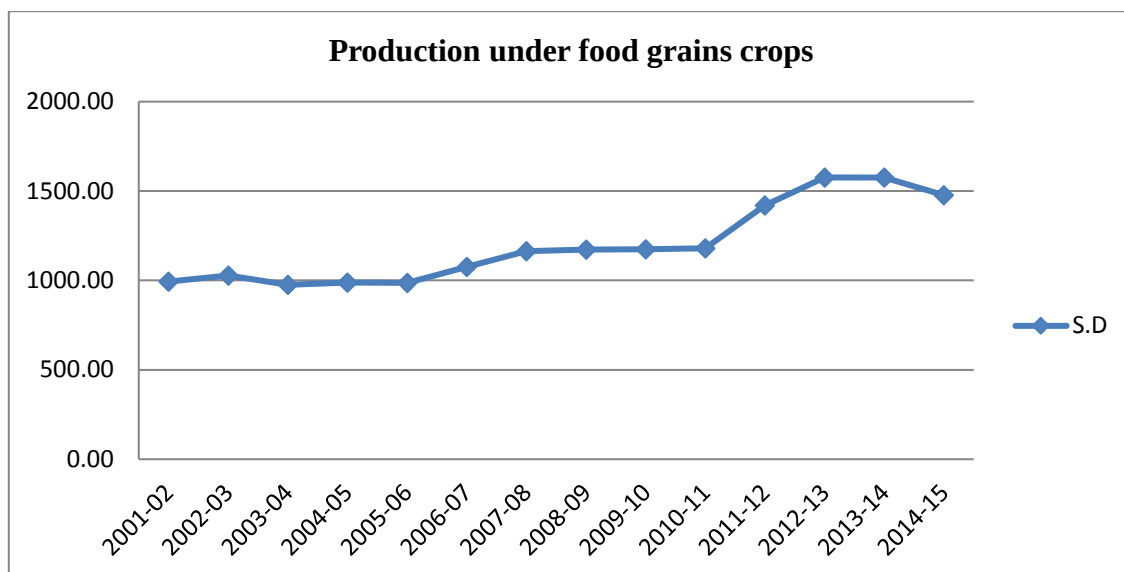


Figure 5.3 shows Standard Deviation of production under food grain crops across 4 zones in Haryana during 2001-2015. S.D is increased over the time period there σ - divergence in production of food grain crops up to 2012-13. After that there is σ -convergence.

Figure 5.4 Standard Deviation of production under cultivation of cash crops zone-wise in Haryana during 2001-2015

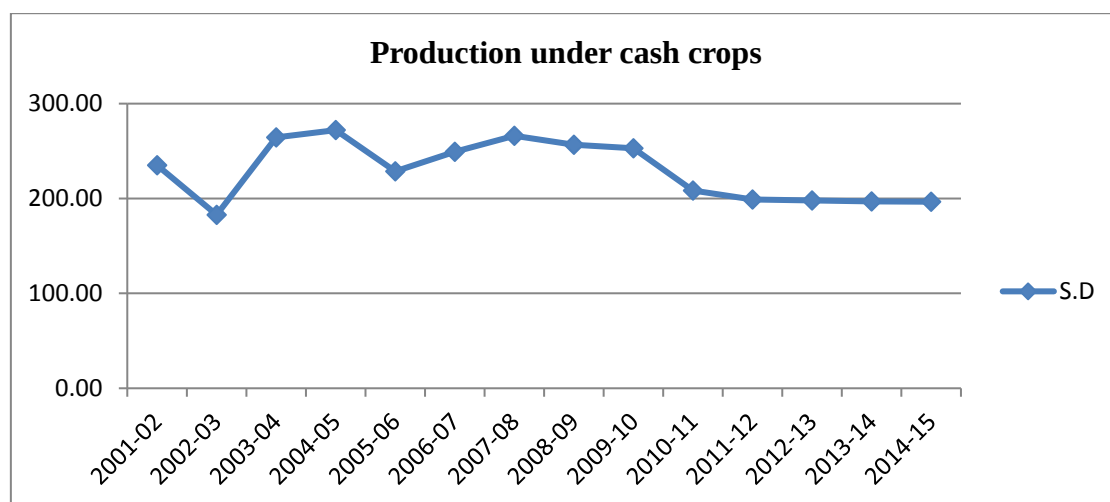


Figure 5.4 shows Standard Deviation of production under cash crops across 4 zones in Haryana during 2001-2015. S.D is decreased over the time period there is σ - convergence in production of cash crops. During 2002-03 to 2003-04 there is σ - divergence because S.D is increased.

Figure 5.5 Standard Deviation of productivity under cultivation of food grain crops zone-wise in Haryana during 2001-2015

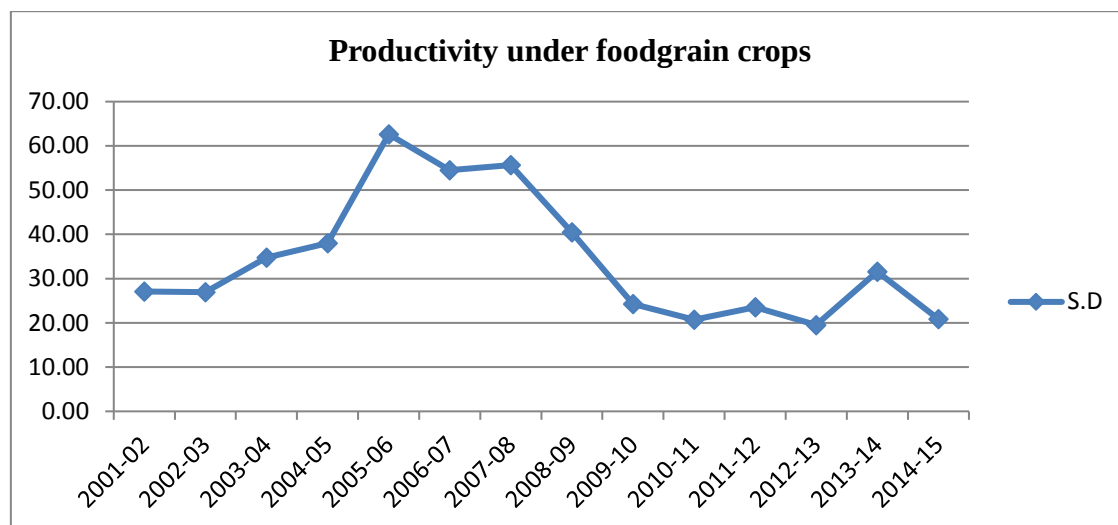


Figure 5.5 shows Standard Deviation of productivity under food grain crops across 4 zones in Haryana during 2001-2015. There is σ – divergence in productivity of food grain crops for the period 2001 to 2005. After the period 2005 there are sigma convergence.

Figure 5.6 Standard Deviation of productivity under cultivation of cash crops zone-wise in Haryana during 2001-2015

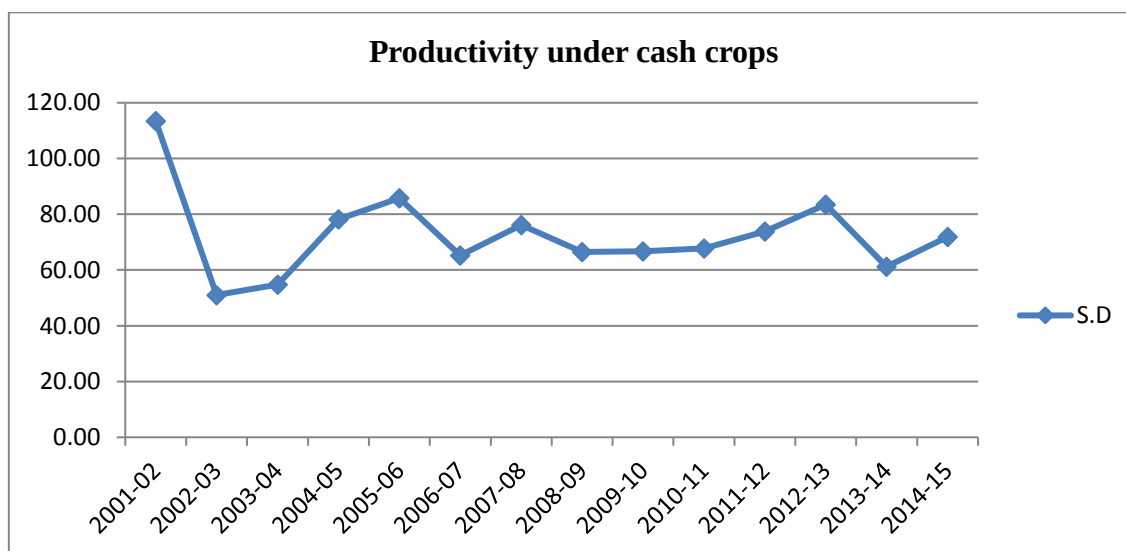


Figure 5.6 shows Standard Deviation of productivity under cash crops across 4 zones in Haryana during 2001-2015. S.D is increased and increased over the time period. There is not significant impact during the period.

Table 5.6.3 σ –convergence for area, production and productivity of food-grains crops in Haryana district-wise

	Intercept	Growth coefficient	R ²
Area	104.12(0.000)	0.71(0.000)	0.43
Production	318.17(0.000)	11.56(0.000)	0.73
Productivity	78.43(0.000)	25(0.180)	0.65
Source: Researcher Calculation			

The table 5.6.3 shows that districts of Haryana have exhibited σ -convergence in area under food grains crops. Higher σ - convergence in production comparison to area and productivity.

Table 5.6.4 σ –convergence for area, production and productivity of cash crops in Haryana district -wise

	Intercept	Growth coefficient	R ²
Area	11.45(0.000)	-0.38(0.000)	0.73
Production	64.17(0.000)	-1.51(0.000)	0.64
Productivity	47.55(0.000)	21(0.001)	0.65
Source: Researcher Calculation			

The table 5.6.4 shows that districts of Haryana have exhibited significant σ - convergence in area, production and productivity in cash crops. Higher σ - convergence in area in comparison to production and productivity.

Figure 5.7 Standard Deviation of area under cultivation of food grains crops across districts of India during 2001-2015

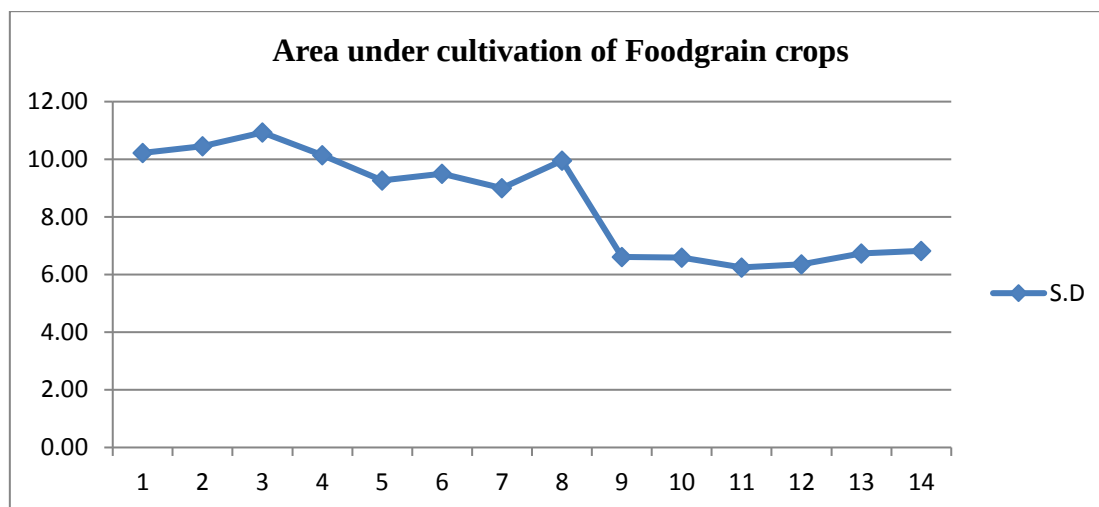


Figure 5.7 shows Standard Deviation of area under food grain crops across districts in Haryana during 2001-2015. S.D is decreased over the time period there is σ - convergence in area of food grain crops.

Figure 5.8 Standard Deviation of area under cultivation of cash crops across districts of Haryana district wise during 2001-2015

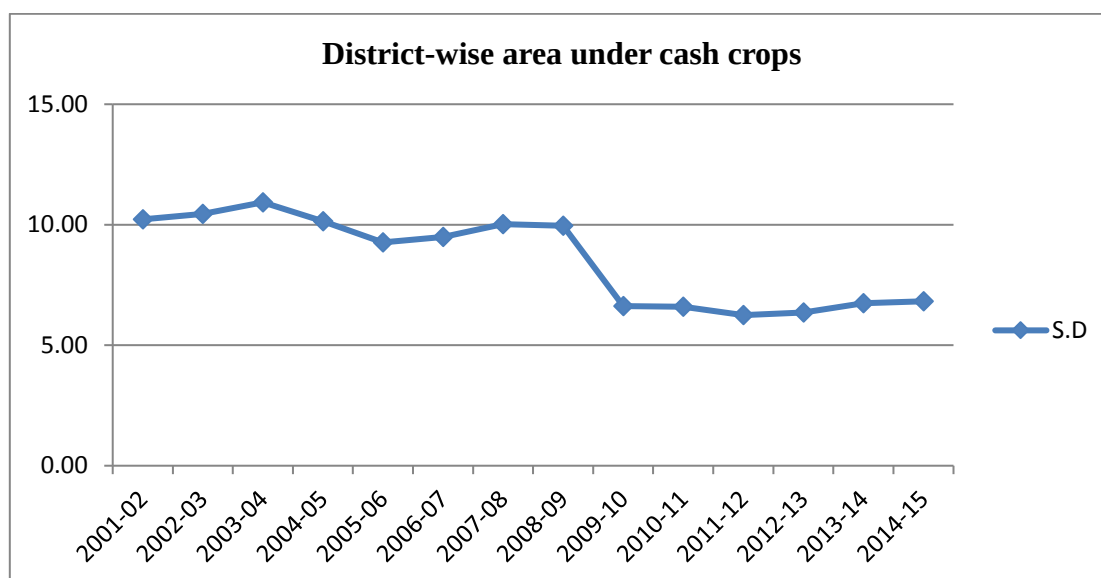


Figure 5.8 shows Standard Deviation of area under cash crops across districts in Haryana during 2001-2015. S.D is decreased over the time period there is σ - convergence in area of cash crops.

Figure 5.9 Standard Deviation of production under cultivation of food grains crops across districts of Haryana during 2001-2015

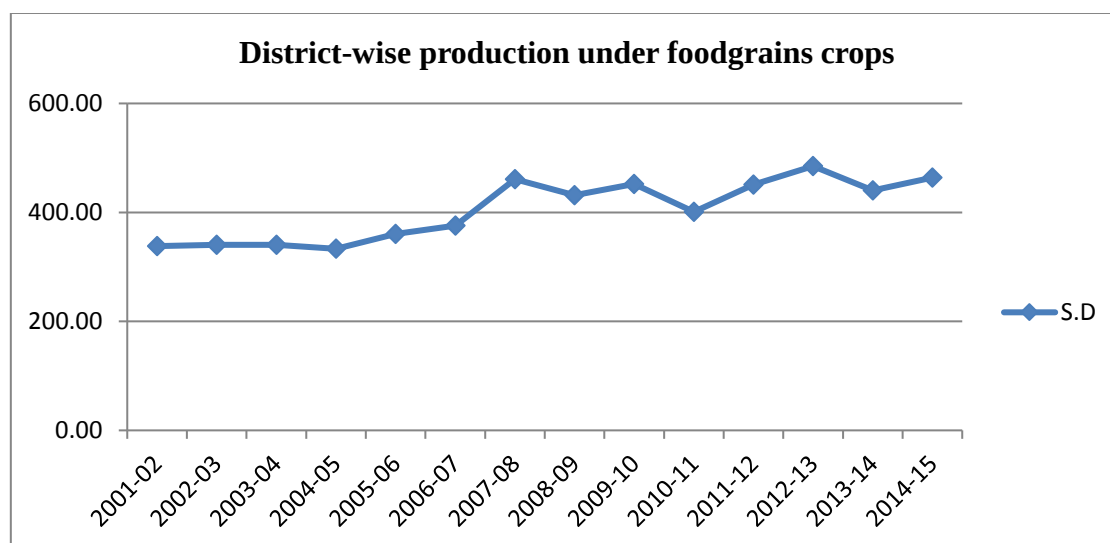


Figure 5.9 shows Standard Deviation of production under food grains crops across districts in Haryana during 2001-2015. S.D is increased over the time period there is σ -divergence in production of food grains crops.

Figure 5.10 Standard Deviation of production under cultivation of cash crops across districts of Haryana during 2001-2015

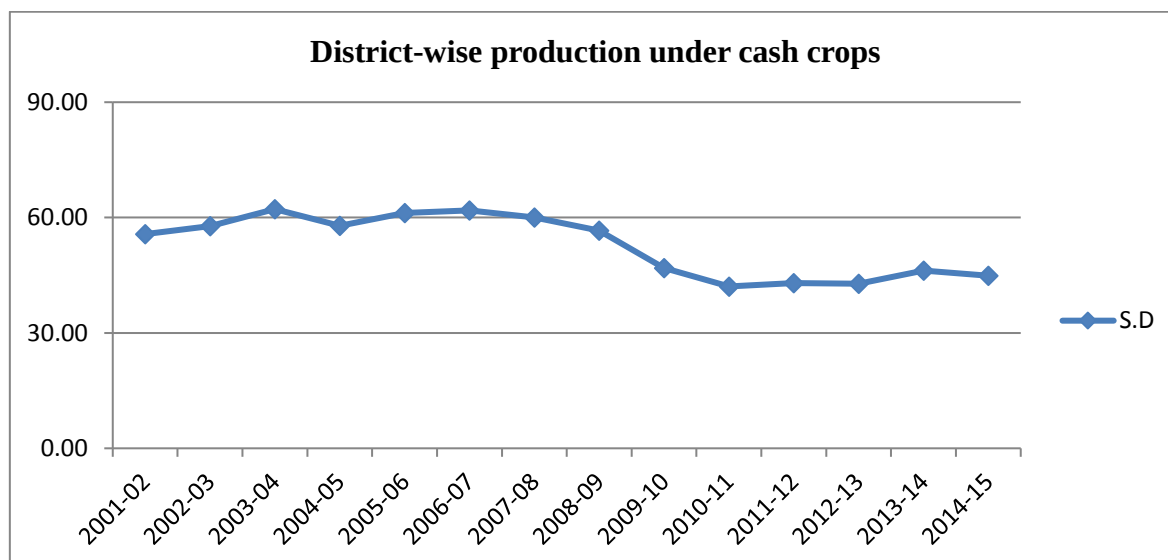


Figure 5.10 shows Standard Deviation of production under cash crops across districts in Haryana during 2001-2015. S.D is decreased over the time period there is σ -convergence in production of cash crops.

Figure 5.11 Standard Deviation of productivity under cultivation of food grains crops across districts of Haryana during 2001-2015

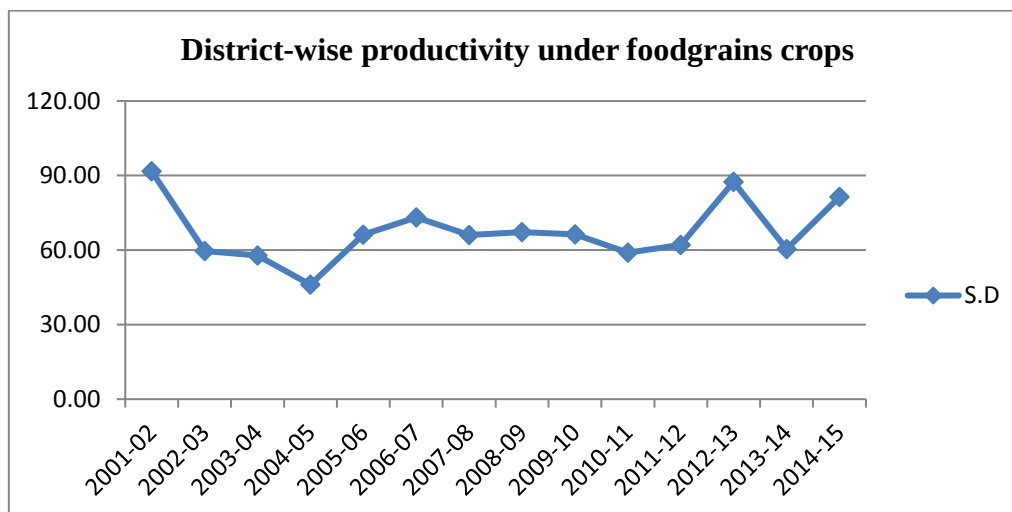


Figure 5.11 shows Standard Deviation of productivity under food grains crops across districts in Haryana during 2001-2015. S.D is decreased and increased over the time period. There is not significant growth in productivity of food grains crops.

Figure 5.12 Standard Deviation of productivity under cultivation of cash crops across districts of Haryana during 2001-2015

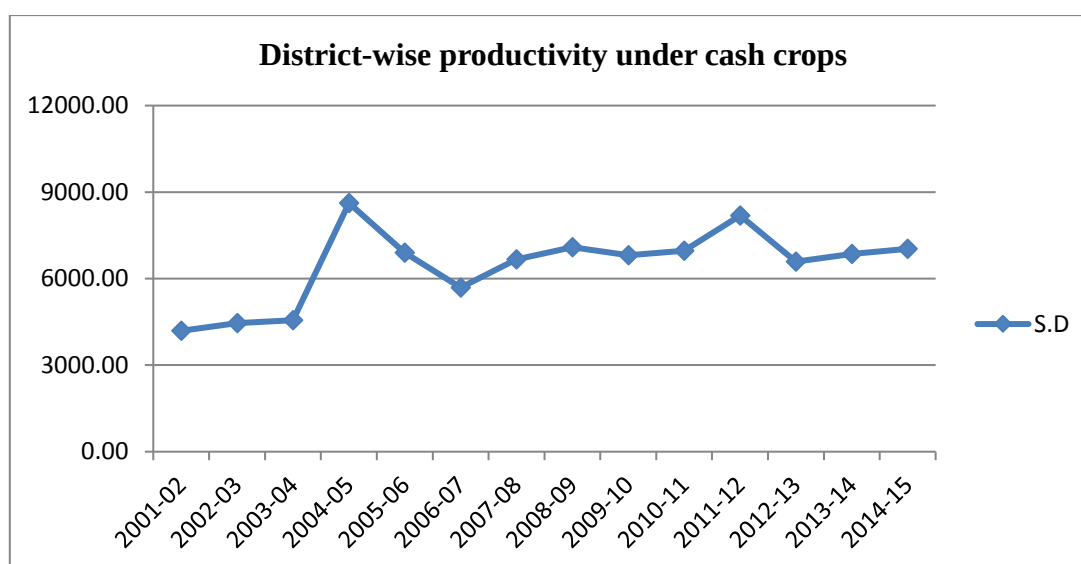


Figure 5.12 shows Standard Deviation of productivity under cash crops across districts in Haryana during 2001-2015. S.D is increased over the time period there is σ -divergence in productivity under cash crops.

5.7) Absolute β -Convergence

B-convergence is empirically examined by estimating regression of the annual growth rate of areas, production and productivity on the initial level of areas, production and productivity. Hence, the test for the absolute β -convergence hypothesis is performed by estimating the following equation by the ordinary least squares (OLS) method.

$$G.W_i = \alpha + \beta X_0 + \mu_i$$

Here, G.W. = Growth rate (2001-2015) of Area (000 hectare), Production (000 tonnes) and Productivity (kg/ha)

α = Intercept, β = Slope Coefficient, μ_i = Disturbance term,

X_0 = Initial area, production and productivity, i = Districts

Partial correlation between growth of area, production and productivity over time and its initial level is negative, there is β -convergence.

Table 5.7.1 β –convergence of food grain crops in Haryana district-wise				
Period		Intercept	Growth Coefficient	R ²
2001-02 to 2014-15	Area	222.42	-4.87	0.73
	Production	714.16	-10.32	0.70
	Productivity	370.17	-33.46	0.60
Source : Researcher Calculation				

The table 5.7.1 shows that there has been β -convergence or divergence in food grain crops. In this table growth has negatively recorded which shows there is beta convergence of area, production and productivity of food grains crops statistically significant.

Table 5.7.2 β –convergence of cash crops in Haryana district –wise				
Period		Intercept	Growth Coefficient	R ²
2001-02 to 2014-15	Area	7.98	0.09	0.60
	Production	49.49	-1.76	0.79
	Productivity	370.17	-33.46	0.66
Source : Researcher Calculation				

The table 5.7.2 shows that β -convergence or divergence in cash crops. In this table positive growth in area which shows there is β - divergence in area of cash crops, on the other side in production and productivity of cash crops is significantly negative than there is β -convergence.

Table 5.7.3 β –convergence of food grain crops zone- wise				
Period		Intercept	Growth coefficient	R ²
2001-02 to 2014-15	Area	2.35	-0.001	0.73
	Production	-6.82	0.002	0.82
Source : Researcher Calculation				

Table 5.7.3 shows zone –wise β - convergence and divergence in food grain crops. This table shows growth has negatively recorded in area which shows β - convergence in area whereas β - divergence in zone-wise production of food grains.

Table 5.7.4 β –convergence of Cash crops in Haryana Zone –wise				
Period		Intercept	Growth Coefficient	R ²
2001-02/ 2014-15	Area	1.08	-0.03	0.53
	Production	-4.16	0.00	0.65
Source : Researcher Calculation				

The table 5.7. 4 shows zone –wise β - convergence and divergence in cash crops. This showed β - convergence in area and beta divergence in production of cash crops.

5.8 Conclusion

CAGR in area under cultivation of food grain was recorded positive in northern and southern zones in Haryana state. There was noted positive growth in crop total oilseed production in northern, central and western zones with 1.64%, 2.10% and 0.46% respectively. It was negative in southern zone with -1.38% respectively. Trend share of average productivity of crop wheat was increased in all zones during 2001 to 2012, after that it was decreased in all zones. On the other side in case of district wise study growth of production under rice cultivation in Rewari with 8.16 percent whereas lowest in Panipat with 0.19 percent. It was negative in Faridabad and Gurgaon. Growth of production under wheat cultivation negative in Faridabad Gurgaon and Rewari with -9.18, -5.59 and -0.19. It was higher in Yamunanagr whereas lowest in Panipat. CAGR under productivity of total food grain positive in Rewari and Jind with 0.01 and 0.68. CAGR under case of crop rice productivity positive in Kurukshetra, Kaithal, Karnal, Sonipat, Faridabad, Gurgaon and Jind with 2.56, 6.03, 5.1, 1.20 and 0.11 respectively over the period. CAGR under case of crop wheat productivity negative in Rohtak, Faridabad, Gurgaon with -1.12, -4.47 and -1.78 respectively over the period of time. Highest variations in case of areas under crop rice in southern and in crop wheat in southern zone over the period. In case bajra lowest variation in central zone, whereas in crop total cereals and maize in northern and central zone respectively. In crop gram and total food grains, highest in central and northern zone respectively. In production crops, wheat, total pulses and total food grains highest variations in central zone during the period

Major Findings

- This chapter found western zone was produced more total food grains production with 1.95 % growth rate. It was negative in northern, western and southern zone over a period of time.

- CAGR area under cultivation of sugarcane is negative in all districts except kaithal, Jhajjar, Gurgaon, Mahendergarh, Jind and Fatehabad.
- This chapter found σ -divergence in area and production of food grain crops and productivity of cash crops. σ -convergence in area and production of cash crops and productivity of food grain crops in Haryana zone-wise. Whereas in case of district -wise sigma convergence in area of food- grain and cash -crops and production of cash crops. σ -divergence in production and productivity of food grain crops. Sigma divergence in productivity under cash crops
- There is beta convergence in area, production and productivity of food grains crops district-wise statistically significant.
- This chapter found, β - convergence in production and productivity of cash crops district-wise.
- There is β - convergence in area whereas β - divergence in production of food grains zone-wise.
- This chapter found β - convergence in area and beta divergence in production of cash crops.

CHAPTER-6

IMPACT OF AGRICULTURAL INPUTS ON AGRICULTURE PRODUCTION IN HARYANA

CHAPTER-6

IMPACT OF AGRICULTURAL INPUTS ON AGRICULTURE PRODUCTION IN HARYANA

6.1) Introduction

In this chapter is an attempt to analyse the impact of agricultural inputs on agricultural production. Agricultural growth is based on progress of agricultural inputs like, HYV seeds, fertilizer consumption, pesticides, rainfall, tractors and irrigation in Haryana. Fertilizers are manufactured mixtures of chemical products it includes Nitrogen (N), Phosphorus (P) and Potassium (K). This chapter divided in two sections: the first section showed impact of agricultural inputs on agricultural production in Haryana. The second section checked the multicollinearity in agricultural inputs. To fulfil the objective multiple linear regression model has been used.

6.2) Multiple Linear Regression Model

It shows relationship the between a dependent variable and two or more explanatory variables. To estimate the influence of agriculture factors on agriculture production, the multiple linear regression analysis by Ordinary Least Square (OLS) estimation has been used. The functional form of multiple linear regression models is given below:

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \mu_i$$

Where,

Y_i = Dependent Variable- Agriculture production of selected food grain crops

α = is the constant or intercept

($X_1, \dots, X_5$) are Independent Variables

X_1 = Irrigation, X_2 = Fertilizer, X_3 = Pesticides, X_4 = Rainfall, X_5 = Tractors

α = Intercept, β_1 = is the slope (beta coefficient) for X_1 ,

Table 6.1.1 Impact of agricultural inputs on total production in northern zone of Haryana				
Dependent Variable: Agricultural production			R-square	0.89
Variables	Coefficient	Standard. Error	T - Statistic	Prob.
Irrigations	2.250	2.371	1.037	0.228
Fertilizers	0.002	0.001	-1.371	0.235
Pesticides	1.741	0.970	1.383	0.132
Rainfall	2.018	1.977	1.795	0.354
Tractors	0.140	0.045	1.021	0.025
Source: Researcher Calculation				

The table 6.1.1 showed impact of agriculture inputs on total production in northern zone during the year 2001-02 to 2014-15. In this table, Agriculture production is dependent variable and fertilizer, rainfall, irrigations, pesticides and tractors are independent variables. R-squared showed total production is 89 per cent depend on inputs. P – Value of irrigations, fertilizer, pesticides, rainfall, and tractors are showed total production depending on irrigations, fertilizer, pesticides, rainfall, and tractors with 22%, 23 %, 13 %, 35% and 02 % respectively. Total production is highly dependent on rainfall in northern zone during the period.

Table 6.1.2 Impact of agricultural inputs on total production in central –zone of Haryana				
Dependent Variable: Agricultural production			R-square	0.78
Variables	Coefficient	Standard. Error	T - Statistic	Prob.
Irrigations	1.250	2.371	1.371	0.106
Fertilizers	0.002	0.001	1.383	0.482
Pesticides	1.741	0.970	1.795	0.230
Rainfall	2.018	1.977	1.021	0.391
Tractors	0.140	0.045	3.132	0.257
Source: Researcher Calculation				

Table 6.1.2 shows impact of agricultural inputs on total production in central zone during the year 2001-02 to 2014-15. In this table, R-squared value showed that total production was depend 78 percent on inputs. P-value showed it depends on irrigations, fertilizer, pesticides, rainfall, and tractors with (10, 48, 23, 39 and 25) percent. Total production is highly dependent on fertilizer in central zone during the period. Standard error and t- value showed that model is significant.

The table 6.1.3 shows impact of agricultural factor on total production in western zone during the year 2001-02 to 2014-15. In this table, R-squared value is 0.93 which showed total production was depend 93 per cent on inputs. Total production was depending on 29 percent on rainfall, whereas 47 percent depend on pesticides. It was 04, and 10 percent depend on fertilizer, and tractors respectively. Standard error and t- value showed significant impact of inputs in this zone.

Table 6.1.3 Impact of agricultural inputs on total production in western zone of Haryana				
Dependent Variable: Agricultural production			R-square	0.93
Variables	Coefficient	Standard. Error	T - Statistic	Prob.
Irrigations	15.551	07.512	02.070	0.10
Fertilizers	00.015	00.006	02.706	0.04
Pesticides	00.931	01.195	00.779	0.47
Rainfall	12.293	10.630	01.156	0.29
Tractors	00.118	00.056	02.082	0.10
Source: Researcher Calculation				

Table 6.1.4 shows impact of agriculture inputs on total production in southern zone during the year 2001-02 to 2014-15. Total production is 80 % depend on agriculture inputs. P - Value of irrigations, fertilizer, pesticides, rainfall and tractors are (0.01, 0.17, 0.14, 0.10 and 0.15). Total production is highly dependent on fertilizer and lowest on irrigations in southern zone during the period.

Table 6.1.4 Impact of agricultural inputs on total production in southern zone in Haryana

Dependent Variable: Agricultural production			R-squared	0.80
Variable	Coefficient	Standard. Error	T - Statistic	Prob.
Irrigations	17.053	4.088	4.172	0.011
Fertilizers	0.015	0.010	1.567	0.177
Pesticides	-3.430	1.986	-1.727	0.144
Rainfall	-4.896	2.472	-1.981	0.104
Tractors	0.041	0.250	-1.687	0.152
Source: Researcher Calculation				

Table 6.2.1 Multicollinearity in Impact of agricultural inputs on total production in northern zone of Haryana

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	T- value	Sig.	Tolerance	VIF
(Constant)	-2447.060	2359.479		-01.037	00.347		
Irrigation	02.250	02.371	-00.294	01.371	00.229	00.456	02.193
Fertilizer	00.002	00.001	00.233	01.383	00.225	00.743	01.347
Pesticides	01.741	00.970	00.401	01.795	00.133	00.421	02.374
Rainfall	02.018	01.977	00.214	01.021	00.354	00.481	02.083
Tractors	00.140	00.045	00.571	03.132	00.026	00.633	01.580
Source: Researcher Calculation							

The table 6.2.1 checked multicollinearity in northern zone of Haryana. In this table VIF value is less than 10, and tolerance value is less than 1, which shows there is not multicollinearity in dependent variables.

Table 6.2.2 Multicollinearity in Impact of agricultural inputs on total production in central zone of Haryana

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Standard Error	Beta	T- value	Sig.	Tolerance	VIF
(Constant)	-3526.060	2131.479		-01.655	00.137		
Irrigation	01.250	02.371	-00.294	01.371	00.029	00.716	01.397
Fertilizer	00.002	00.001	00.233	01.383	00.225	00.743	01.126
Pesticides	01.741	00.970	00.401	01.795	00.203	00.524	01.907
Rainfall	02.018	01.977	00.214	01.021	00.354	00.616	01.623
Tractors	00.140	00.045	00.571	03.132	00.026	00.709	01.411

Source: Researcher Calculation

Table 6.2.3 Multicollinearity in Impact of agricultural inputs on total production in western zone of Haryana

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Standard. Error	Beta	T- value	Sig.	Tolerance	VIF
(Constant)	9823.296	6252.135		01.571	00.177		
Irrigation	15.551	07.512	00.414	02.070	00.093	00.308	03.242
Fertilizer	00.015	00.006	00.608	02.706	00.042	00.245	04.080
Pesticides	00.931	01.195	00.163	00.779	00.470	00.285	03.535
Rainfall	12.293	10.630	00.238	01.156	00.300	00.292	03.430
Tractors	00.118	00.056	00.481	02.082	00.092	00.232	04.319

Source: Researcher Calculation

The table 6.2.3 checked multicollinearity in western zone of Haryana. In this table VIF value are 3.242, 4.080 3.535, 3.430 and 4.319 of irrigations, fertilizer, pesticides rainfall and tractors which showed not multicollinearity. Tolerance value also showed not multicollinearity in explanatory variables in this zone.

Table 6.2.4 Multicollinearity in Impact of agricultural inputs on total production in Southern zone of Haryana

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Standard. Error	Beta	T-value	Sig.	Tolerance	VIF
(Constant)	462.249	301.005		00.153	00.884		
Irrigation	17.053	04.088	00.943	04.172	00.009	00.749	01.336
Fertilizer	00.015	00.010	-00.830	01.567	00.178	00.136	07.344
Pesticides	-03.430	01.986	-00.943	-01.727	00.145	00.128	07.791
Rainfall	-04.896	02.472	-00.665	-01.981	00.104	00.339	02.949
Tractors	00.41	00.25	00.373	-01.687	00.152	00.780	01.281

Source: Researcher Calculation

The table 6.2.4 checked multicollinearity in western zone of Haryana. In this table VIF value are 1.336, 7.344, 7.791, 2.949 and 1.281 of irrigations, fertilizer, pesticides rainfall and tractors which showed not multicollinearity. Tolerance value also showed not multicollinearity in explanatory variables in this zone.

Conclusion

This chapter was an attempt to study the impact of agricultural inputs on agricultural production. For the purpose the multiple regression model was applied. On the base of its finding it is concluded that

- Total production is highly dependent on rainfall in northern zone whereas in central zone it's depending on fertilizer during the period.
- Total production is dependent on pesticides, fertilizer, and tractors with 47, 04, 27 and 10 percent in western zone.
- It is highly dependent on fertilizer in southern zone during the period.

CHAPTER-7

MAJOR FINDINGS AND RECOMMENDATIONS

CHAPTER - 7

MAJOR FINDINGS AND RECOMMENDATIONS

7.1) Introduction

Disparities in economic development prevail in terms of per capita income, poverty, literacy, gross enrolment ratios, life expectancy, indicators of mortality (maternal mortality, life expectancy at birth) and access to safe drinking water etc. Not only are there interstate disparities but even within the states variations in development. Economic growth rates also reflect economic disparity within the country because economic growth rates vary considerably among states. In India, production and productivity has been increasing since green revolution with increasing use of high yielding seeds, synthetic fertilizers, and extent of irrigation, mechanical power and electricity in farm operations. A comparison of the growth performance of agriculture at state level showed that some regions have performed better than other regions in different time periods. The regional disparities in agricultural development arises out of varied agro-climatic conditions, resource endowment, etc., tended to get further accentuated because of varying levels of investment in agriculture and rural infrastructure.

Several studies such as Mehra (1981), Hazell (1982) etc. have pointed out that the new strategy of agricultural production based on HYV seed fertilizer technology has contributed to the growth in production and productivity in India. Many studies such as those by Evans and Karras (1996), Sala-i-Martin (1996), and Evans (1997) found beta convergence in per capita log income among the states of the U.S.A, Mukherjee and Kuroda (2003) explored the question of convergence in total factor productivity across fourteen major agricultural states of India covering the period 1973-1993, and found no evidence of sigma convergence. Previous studies were based on global and Indian level studies. This study is based on special Haryana district-wise and zone wise.

7.2) Major Findings

The major findings of study are discussed as follow

Disparities of Agriculture Determinants in Haryana

- CAGR area under HYV of wheat positive in three zones except southern, whereas CAGR under maize positive highest in central with 2.82 followed by northern, southern and western zones respectively.
- CAGR of total fertilizer highest in southern zone, whereas lowest in western zone with 0.82. Consumption of pesticides is increased in northern zone, whereas decrease in central and southern zones. Rainfall was increased in northern, central and southern zones, whereas it has decreased in western zone.
- Agricultural credit societies in the Haryana for the years 2001-02 to 2014-15. Number of membership, share capital, own capital, working capital, loan advanced and loan recovered was increased during the period, whereas number of agriculture societies and overdue was decreased.

Area under cultivation of major food grains crops

- The percent share of northern zone is area under cultivation of crop rice was 39.9 during the study. The central zone percent share of rice was decreased whereas share of rice in western and southern zone has been increased. The percentage share of rice was higher in northern zone is compared to central, western and southern zone because highest irrigation facilities in this zones compared to others zone.
- The highest percentage share of area under cultivation of wheat was in western zone is compared to central, northern and southern zones. Area under cultivation of wheat was increased in northern, central and western zones, whereas in southern zone it was decreased.

- Growth rate in cultivation of crop gram was negatively in northern and western zone whereas it was positively in central and southern zone. Except northern and western zone growth in total pulses was recorded positively during the period of time.
- CAGR in area under cultivation of food grain was recorded positive in northern and southern zones in Haryana.
- District-wise CAGR in area under rice cultivation was negative in Kaithal, Panipat, Faridabad and Gurgaon with -2.8, -0.19, -3.55 and -3.08 respectively. It was highest in Bhiwani with 5.17 and lowest in Ambala with 0.75 during the period. There are not much difference between Yamunanagar and Sonipat.
- CAGR in area under wheat cultivation negative in Faridabad, Gurgaon, Rewari and Mahendergarh. It was found highest in Rohtak and Yamunanagar.

Area under cultivation of cash crops

- Western zone were having highest area in crop of total cotton over a period of time. Northern zone were having lowest area under cultivation, it was 0.24 % over the study because this areas not more profitable of this crop.
- CAGR area under cultivation of sugarcane is negative in all districts except kaithal, Jhajjar, Gurgaon, Mahendergarh, Jind and Fatehabad. CAGR area under cultivation Oilseed is higher in Kurukshatra with 18.42 and lowest in Karnal with 0.08. It was negative in Ambala, Panchkula, Kaithal, Sonipat, Faridabad, Gurgaon, Jind and Fatehabad.

Production under cultivation of food grains crops

Production under cultivation of food grains crops found more or less disparities in Haryana.

- In case of crop bajra western zone have more production; it was followed by southern, central, and northern zone respectively. Production of bajra was lowest in northern zone

due to highest irrigation in this area whereas bajra required lowest irrigation facility. But the trend share of production of bajra was increased during the period except central zone.

- This study found growth rate of rice production positively in central and southern zone of Haryana state. It was higher in western zone.
- CAGR of wheat production was negative in southern zone.
- CAGR of bajra was highest in southern zone. It was positively in northern and southern zone of Haryana state. Except western zone, there were not much disparities in growth rate in other three zones.
- Growth rate of total production in total cereal was higher in southern zone, whereas lowest in northern zone.
- Growth of production under rice cultivation in Rewari with 8.16 percent whereas lowest in Panipat with 0.19 percent. It was negative in case of Faridabad and Gurgaon. Growth of production under wheat cultivation negative in Faridabad Gurgaon and Rewari with - 9.18, -5.59 and -0.19. It was higher in Yamunanagr whereas lowest in Panipat. Growth of Production under bajra was higher in Kaithal with 7.63 and lowest in Sirsa.
- Coefficient of variation shows highest disparities in production of crop rice, total cereal and gram in southern zone whereas disparities were observed in case of bajra and maize in northern zone. In production crops, wheat, total pulses and total food grains highest variations in central zone during the study period.

Production under cultivation of cash crops

- Northern zone have highest production in case of sugarcane whereas it was lowest in southern zone during the period. The trend of share in production of western and southern zone is decreasing and increasing in northern and central zone.

- This study found growth rate of sugarcane production was recorded positively in northern and central zones with 0.06 % and 1.19 % respectively, whereas negative growth rate was recorded in western and southern zone with -6.97% and -1.63 % over the study period.
- CAGR of production total cotton was not recorded in northern zone over a period. It was highest in central zone with 2.20%. There was recorded positive CAGR in crop Rapeseed and mustard production in northern and southern zones with 6.02 % and 1.21 % respectively. There was noted positive growth in crop total oilseeds production in northern, central and western zones with 1.64 %, 2.10 % and 0.46 % respectively.
- CAGR production under total oilseed negative in Kaithal, Sonipat, Faridabad and Gurgaon. CAGR production under Rapeseed and Mustard was negative in Faridabad and Gurgaon. There are not much disparities in Ambala, Panchkula, Kurukshetra, Kaithal, Karnal and Bhiwani.

Productivity under cultivation of food grain crops

- Northern zone was recorded higher average yield of crop rice. It was 4057.21 kg/ha over the study period.
- Trend share of average productivity of crop rice was decreasing. Trend share of average productivity of crop wheat was increased in all zones during 2001 to 2012, after that it was decreased in all zones.
- Productivity under total cereal cultivation negative in Panipat, Sonipat, Rohtak, Jhajjar and Faridabad with -2.86, -2.90 and -1.75. It was highest in Bhiwani with 4.17 and lowest in Jind with 1.13. Productivity under total pulses cultivation positive in Rohtak, Jhajjar, Mahendergarh, Hisar and Sirsa with 2.81, 0.01, 0.35, 14.25 and 2.75 respectively. CAGR under productivity of total food grain positive in Rewari and Jind with 0.01 and 0.68.

- The compound growth rate of area, production, and yield of sugarcane during 2000-01 to 2011-12 has declined compared to the 1980s. The decline in growth rate of yield during this period is because of relatively higher decline in growth rate of production compared to decline in growth rate of area. So there are required to increase productivity of this crop to avoid fluctuations in production. Both public and private sector investment in research and development (R&D) needs to be encouraged.
- It was found σ - divergence in area and production of food grain crops and productivity of cash crops. σ -convergence in area and production of cash crops and productivity of food grain crops in Haryana (zone-wise).
- It was found that in case of production food grain and cash crop beta divergence. It means the disparities in production of cash crops.
- In case of district-wise sigma convergence in area of food-grains and cash crops and production of cash crops. σ -divergence in production and productivity of food grain crops. Sigma divergence in productivity under cash crops.

Impact of agricultural inputs on total production

- Agriculture production is dependent variable and Fertilizer, Rainfall, Irrigations, Pesticides and Tractors are independent variables. Total production is highly dependent on rainfall in northern zone during the period.
- Total production is highly dependent on fertilizer in central zone during the period.
- In Central zone production is depends 78 percent on agricultural inputs. P-Value of irrigations, fertilizer, pesticides, rainfall, and tractors are (0.10, 0.48, 0.23, 0.39 and 0.25).
- In western zone total production was dependent 93 percent on inputs.
- In southern zone 80 percent agricultural production depend on agricultural inputs.

7.3) Recommendations

Many studies have been conducted to measure the pattern of regional development among states. Intra state also disparities attract attention of researchers. In India various states are growing at different level and gap between the developments of various states is well observable in India. In the present study an attempt was made to study the district-wise regional disparities in agricultural growth in Haryana. On the base of forgone analysis the following recommendations are made.

- Irrigation with high yielding variety seeds and fertilizer forms a significant input to increased agricultural production. Out of the agricultural inputs, irrigation availability is the major input in the agricultural sector. The northern Haryana which was most irrigation benefited region along with other inputs rather than other regions. The maximum irrigation was provided to sugarcane crop than other crops. Southern zone have low irrigation facilities. Therefore, the deliberate efforts should be made to provide the water to subordinate crops like cotton, rabbi jowar etc. in the agricultural sector.
- Haryana is having largest area under rice crop. However, productivity is lowest. The reason for low productivity is that rice is being grown in the country under various agro-ecologies in both irrigated and rain fed systems. National Food Security Mission (NFSM), which is being implemented in 25 states of the country, should focus to improve productivity in Haryana state.
- There is need to ensure farmers access to sufficient quantities of improved seeds, chemical fertilizers and other complementary inputs to improve their rice productivity.
- CAGR production under total oilseed negative in Kaithal, Sonipat, Faridabad and Gurgaon. CAGR production under Rapeseed and Mustard was negative in Faridabad and Gurgaon. Government should focus of the strategy is to increase production of traditional oilseeds and bring more area under oil-palm cultivation through mission mode farm projects.

- Growth rate of total pulses was negative except southern zone during the period.
- The chemical fertiliser technology is also limited to the crops that have other available inputs like irrigation. Moreover, the much disparity was observed in the chemical fertiliser in the regions of Haryana. CAGR was lowest in western zone compared to others three zone. So, Government should take care of supply of fertilizers to farmers at ruling prices.
- Agriculture credit is an important factor for agriculture production. Number of societies is decreased during the period. CAGR is lowest in Karnal, Panipat, Kurukeshatra and Rewari compared to other districts. There is need to improving credit supply in state for farmers.
- HYV was used only few crops like rice, wheat, Jowar and bajra. Effort is required to encourage the farmers to use improved and new varieties of seeds of cereals, pulses, groundnut and cotton. Government should also the supply of certified seed at reasonable prices. Small and marginal farmer who are large number, may be provided with HYV seed at subsidised rate. This would help in improving the growth performance of cereal, pulses and oilseeds.
- Agricultural productivity can also be increased by changing the pattern of production towards more intensive system of cultivation or by progressively changing cropping pattern from low value crops to high value crops.
- σ -divergence in area and production of food grain crops. Government should provide facilities for improved production of food grain crops.
- District wise σ -divergence in productivity under cash crops. Newer varieties, resource conservation technologies like zero till seed drill need to be promoted in state for enhancing production and productivity.
- Availability of tractors highest in western zone. CAGR are negative in all three zones, except southern zone. Hence, Bank should be increasing finance made availability to farmers of these districts for purchase of machineries'.

- There are needed to be taken to enhance agricultural growth in India. Therefore, to provide agricultural sector a growth momentum, more and more public investment is necessary for intensive agricultural development in the lagged region especially in the areas like dry.

7.4) Limitations of the study

There are many restrictions in this study. All variables which are used in this study based are on the secondary information compiled from Ministry of Agriculture Government of India. There are following limitations of the study:

- The variables taken in the study are selected on the basis of availability of data. However, the selected variables represent the phenomenon appropriately as a number of other studies have adopted almost similar variables for the purpose.
- The number of districts in Haryana has been increasing continuously. At present there are 22 districts. The increase in number has created the problem of comparability of values in the districts over the period of time. However the change in the number of districts does not affect the ranking of the districts at particular point of time.
- This study included selected major food-grains and cash crops. Food grains crops are rice wheat, jowar, bajra, maize, gram, total cereals, total pulses and total food grains production and Cash crops are sugarcane, total cotton, rapeseed & mustards and total oilseeds.

7.5) Future research directions

- The present study is based on the availability of data on different agriculture variables. There are certain variables those have not been include in to the present study due to the non availability data. Hence one can extend this study by adding the information on the left out variables.
- This study, further, can be extended to compare with other state their policy phenomena regarding the development.

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