A SPACIO-TEMPORAL ANALYSIS OF AGRICULTURAL DEVELOPMENT IN HIMACHAL PRADESH

THESIS

By

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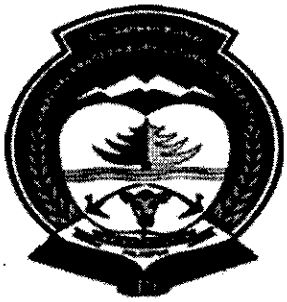

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In the Name of Allah,
the Most Gracious, the
Most Merciful


This thesis is lovingly dedicated
to my noble parents and family
who have always been a source
of support, motivation and
inspiration in my life.

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CERTIFICATE – I

This is to certify that the thesis entitled **"A Spacio-Temporal Analysis of Agricultural Development in Himachal Pradesh"** submitted in partial fulfillment of the requirements for the award of the degree of **Master of Science (Agriculture)** in the discipline of **Agricultural Economics** of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur is a bonafide research work carried out by **Najibullah (A-2010-30-74)** son of **Shri Ghulam Hassan** under my supervision and that no part of this thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been duly acknowledged.

(Dr Virender Kumar)
Major Advisor

Place: Palampur

Dated: 6th June, 2012

CERTIFICATE - II

This is to certify that the thesis entitled "**A Spacio-Temporal Analysis of Agricultural Development in Himachal Pradesh"** submitted by **Najibullah (A-2010-30-74)** son of **Shri Ghulam Hassan** to the CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur in partial fulfillment of the requirements for the degree of **Master of Science (Agriculture)** in the discipline of **Agricultural Economics** has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

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Chairperson,
Advisory Committee

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Member & Dean's Nominee

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I should say that the errors and mistakes, if any, are mine.

Place: Palampur (HP) India ----------

Dated: the 6th June, 2012 ***Najibullah***

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LIST OF ABBREVIATIONS USED

Sr. No.	Abbreviation	Full Form
1	sq km	Squared Kilometer
2	t	Tonnes (1000 kilograms)
3	ha	Hectare
4	P	Production
5	Y	Yield
6	A	Area
7	CAGR	Compound Annual Growth Rate
8	P_1	First Period
9	P_2	Second Period
10	O	Overall Period
11	ADI	Agricultural Development Index
12	HI	Herfindahl Index
13	GSDP	Gross State Domestic Product
14	WPR	Work Participation Rate
15	AWPR	Agricultural Work Participation Rate
16	kg	Kilogram
17	GCA	Gross Cropped Area
18	TCA	Total Cropped Area
19	NSA	Net Sown Area
20	NIA	Net Irrigated Area
21	GIA	Gross Irrigated Area
22	p.a.	Per Annum
23	C.V.	Coefficient of Variations
24	MA	Moving Average
25	TE	Triennium Ending
26	Fig.	Figure
27	No.	Number
28	HPDR	Himachal Pradesh Development Report
29	OECD	Organization for Economic Co-operation and Development
30	WDR	World Development Report
31	CSO	Central Statistics Organization
32	HDI	Human Development Index
33	Agril.	Agricultural
34	Contd.	Continued
35	Misc.	Miscellaneous
36	n.s.	Not Significant
37	GDP	Gross Domestic Product
38	viz.	namely
39	etc.	etcetera (and so on, and so forth)
40	i.e.	id est (that is to say)

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Chapter 1

Introduction

"Most of the people in the world are poor, so if we knew the economics of being poor, we would know much of the economics that really matters. Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor."

(Theodore W. Schultz Nobel Laureate in Economics 1979)

1. INTRODUCTION

1.1. The Importance of Agriculture for Development

Agriculture sector plays a strategic role in the process of economic development. It has contributed to the economic prosperity of developed countries and its role in the economic development of less developed countries is of vital importance. Agriculture can work in concert with other sectors to produce faster growth, reduce poverty and sustain the environment. Agriculture contributes to development in many ways i.e. as an economic activity, as a livelihood and as a provider of environmental services. *As an economic activity*, agriculture can be a source of growth for the national economy, a provider of investment opportunities for private sector and a prime driver of agriculture-related industries as well as the rural non-farm economy. The industries and services linked to agriculture in value chains often account for more than 30 per cent of gross domestic product (GDP) in transforming and urbanized countries. In agriculture-based countries, it generates on average 29 per cent of GDP and employs 65 per cent of the labour force. Agricultural production is vital for food security because it is a source of income for the majority of the rural poor in the world. *As a livelihood*, it sustains the life of an estimated 86 per cent of rural people, provides jobs for 1.3 billion smallholders and landless workers and a foundation for viable rural communities. *As a provider of environmental services,* although agriculture brings forth some negative environmental outcomes, it causes good environmental ramifications such as, sequestering carbon dioxide (CO_2), managing watersheds, providing recreation, shaping the landscape, conservation of the natural resources of soil and water and preserving biodiversity. However, the way agriculture contributes to development varies across countries depending on how they rely on agriculture as a source of growth and an instrument for poverty reduction (WDR 2008).

The study of economic history indicates that an agricultural revolution is the basic pre-requisite for economic development. Agriculture sector has the potential to be the industrial and economic springboard from which a country's development can take off. Agricultural activities are usually concentrated in less developed rural areas where there is critical need for rural transformation, redistribution, poverty alleviation and socio-economic development (Ogen 2007). Similarly, the sector harnesses poor people's key assets of land and labour and creates a vibrant economy in rural areas where majority of rural poor people live. Agriculture connects economic growth and the rural poor,

increasing their productivity and incomes. Agricultural growth, particularly through increased agricultural productivity, reduces poverty by lowering and stabilizing food prices, improving employment, increasing demand for consumer goods and services and stimulating growth in the non-farm economy (OECD 2006). Furthermore, a sustainable and efficient agriculture sector enables a country to feed its growing population, generate employment, earn foreign exchange and provide raw materials for agriculture-based industries (Ogen 2007). As agriculture itself grows, it makes a *product contribution* because any increase in the net output of agriculture represents a rise in total product of the country, since the latter is the sum of the increases in the net products of several sectors. When agriculture sector trades with other sectors, it renders *a market contribution* because it provides opportunities by offering part of its product on domestic or foreign markets in exchange for goods produced by other sectors at home or abroad. Finally, when agriculture transfers resources (capital or labour) to other sectors, these resources being productive factors, it makes *a factor contribution (*Kuznets 1965*)*. Hence, agriculture sector has multiplier effects on any nation's socio-economic and industrial fabric because of its multi-functional nature. Its multiplier effects on the economy are estimated to be in the range of 1.35 to 4 (Ogen 2007 and OECD 2006). Although, agriculture is a primary contributor to growth, particularly in the initial stages of development, it neither can function in isolation from the wider economy, nor it can drive growth alone. Rather, it requires a supportive and enabling environment as well as structural and institutional changes in rest of the economy (OECD 2006).

Despite this crucial role of agriculture in economic development, both the academic and donor communities lost interest in the sector starting in the mid 1980s. It was mostly because of low prices of basic agricultural commodities in the world market, as a result of the success of the Green Revolution in Asia. After the two decades of neglect, interest in agriculture is re-emerging. There are three basic reasons, a revolution in knowledge of basic genetics structures and mechanisms providing scope for productivity growth in agriculture, a supermarket revolution that is transforming food retail markets and supply chains creating opportunities for farmers to diversify in favour of high value crops so that to capture some of the value added being generated by supermarkets and a new comprehension that economic growth is the main vehicle for reducing poverty and that growth in the agricultural sector plays a major role in overall growth and connecting poor to growth (Timmer 2005).

1.2. Linkage Effects of Agriculture Sector

Production and consumption linkages exist both within agriculture as well as between agricultural and non-agricultural sectors. Agricultural production creates forward production linkages when agricultural outputs are supplied to non-agricultural sector as inputs. Agricultural growth can, thus, help with expansion of agro-food processing and processed food marketing, which in turn creates new engines of growth and substitute food imports. Through its demand for intermediate inputs, such as fertilizers, marketing services etc., agriculture generates backward production linkages. Furthermore, the consumption linkages generated by increased rural income is the strongest linkage of agriculture in the process of development. Rural households provide an important market for domestically produced manufactures and services especially in the early stages of development. Surplus agricultural income provides saving for investment in both rural and urban areas. The backward linkages are basically strong in the early while forward linkages strengthen at the later stage of development. Nutrition is said to be a key determinant of growth. It can influence growth directly through enhancing labour productivity and indirectly via improvement in life expectancy. In a nutshell, the strong linkage effects of agriculture suggest that agricultural growth could lead to broader economic growth during the early stages of industrialization even in more open countries (Diao *et al.* 2007).

1.3. Himachal Pradesh and its Agriculture Sector

Himachal Pradesh is one of the dynamic hilly and mountainous states of Indian Union located in Western Himalayas. It has an area of 55,673 sq km ranking it 17th in terms of area, and a population of 68.6 *lakh* ranks it 21st in terms of population among States and Union Territories. Over 90 per cent of its population lives in rural areas. Administratively, it is divided into 12 districts, 82 *teshils* and 77 development blocks. The city of Shimla is the Capital of the State. Following several changes and re-organization in its administrative structure, Himachal Pradesh became a full-fledged state of Indian Union in January 1971. It was overwhelmingly rural and agrarian state, major parts of the state were in the immense shortage of infrastructure facilities and agriculture was the least developed. This full statehood gave a new course to the pace of its development (HPDR 2005 and Kant 2005). As compared to the neighbouring states, it grew at a faster pace in 1990s than in 1980s. However, the growth of state's economy has mostly depended on its

performance of agriculture sector. The state's economic growth was the highest (6.4% per annum) between 1985-86 and 1990-91. This corresponded to the time when the growth of agriculture sector was also the highest (4.72% per annum). Similarly, the annual growth rate of the economy was the lowest between 1975-76 and 1980-81. This was the period when agriculture sector experienced a negative growth rate (0.34% per annum). Thus, agriculture sector has been crucial for the growth of the economy of Himachal Pradesh (HPDR 2005).

The state has large range of mountains and valleys rising from 350 metres to 7000 metres above mean sea level. Its climate ranges from sub-tropical to sub-arctic cold with annual rainfall varying from 350 mm to 3800 mm. The temperature ranges from -25° C to 42° C. The state has snow-fed perennial rivers and rivulets flowing in almost all its parts. Most of the territory of Himachal Pradesh constitutes forests, pastures and grazing lands. Only less than 10 per cent (5.1 *lakh* hectares) of its geographical area is under cultivation. However, the topography, soil, climate, rainfall and temperature provide the state with vast opportunities for agriculture and horticulture sectors. A large number of crops are grown in the state. It is especially known for its fruits and vegetables production. The accomplishments in the fruit farming have earned the state an eminent place in the horticultural map of India and the state has come to be known as *'Apple State of India'* (HPDR 2005 and Sharma *et al.* 2003).

Agriculture in the state suffers from certain limitations. Most of the farming is rainfed and only about one *lakh* hectares of its net sown area receives irrigation. Operational holdings are small and scattered. Fruit cultivation is thriving on old plantations whose bearing is low and farm mechanization is insufficient. The process of crop diversification in the state has been constrained by natural, technological, infrastructural and institutional factors. Awareness level of farmers is low and technologies are outdated (Chand 1997 and HPDR 2005).

The hill and mountain areas of Himalayan region are ecologically fragile and generally less developed. Majority of hill inhabitants depend upon agriculture for their livelihood. Due to low and stagnant productivity, the output produced by the sector is unable to meet the requirements of hill people and there is no surplus for satisfying their other needs. While increasing productivity through expansion of land is not economically and environmentally desirable, decrease in size of holding and productivity of hill

agriculture reduced capacity of the agricultural economy to provide food, fuel, fodder and marketable surplus to growing hill population (Chand 1997). Agricultural development in the mountainous regions is restricted by the mountain specificities, viz., inaccessibility, marginality, fragility, niche and human adaptation mechanism created by the unique vertical dimensions that distinguish them from the plains and other ecosystems. The first three specificities contribute in varying degrees to physical isolation of hilly regions while the later two indicate positive features and potential for agricultural development. Thus, agricultural development requires a different approach in these regions (Sharma 2005). Among various hilly states and regions, Himachal Pradesh is recognized as the most progressive state which has achieved considerable progress in socio-economic development of its people and it is considered as a model for development of Hindukush Himalayan region. However, due to hilly terrain and mountainous topography, roads and other infrastructure required for industrial development is generally poor (Chand 1997).

1.4. Rationale of the Study

Like any other phenomenon, agriculture is subject to variations occurring over time and across area. In other words, agricultural development indicators change in their magnitude as a function of time across regions. These changes have got more momentum, *inter alia*, in Indian agriculture with the commencement of the Green Revolution. It was driven by a technological revolution comprising a package of inputs, viz., improved seeds, fertilizers, irrigation and pesticides, which together increased crop yields and production dramatically. Its implementation depended on strong public support for developing the technologies, building up the required infrastructure, ensuring that market, finance and input systems worked, and that the farmers had adequate knowledge and economic incentives to adopt the technology package (Hazell 2009). Hence, the Green Revolution added new dimensions to linkage effects of agriculture. The Green Revolution in India started in the mid 1960s; with its success India attained food self-sufficiency within a decade. Furthermore, Indian economic reforms initiated in 1991, signing of the agreement of World Trade Organization (WTO) and consequent liberalization of trade necessitated many structural and institutional changes, among others, in agriculture sector. The agricultural development indicators of Himachal Pradesh underwent tremendous changes since then. New trends are emerging and past provide us with lessons of success and failure to improve upon future actions. The process of agricultural diversification, which was hitherto confined to selected pockets and valleys in the higher and mid-hill areas, has

expanded to new areas in the low and mid-hills of the state. Many new developments such as protected cultivation, organic farming, micro irrigation and growing of more lucrative crops have added new dimensions to agriculture in the state.

Regional economic growth and disparities have attracted considerable attention among researchers, planners and policy makers. Agricultural development is not even rather it is dominated by vast inter-regional as well as intra-regional disparities. The existence of such discrepancies often acts as a restraint to agricultural development in the state. Agro-climatic conditions, resource endowments, topography, institutional and socio-economic factors are said to be responsible for these disparities. As a result of these disparities, some districts might have progressed more as compared to others. An empirical examination of these developments was deemed necessary because it could provide an exhaustive scrutiny of agricultural development in the state that will help policy makers and planners in decision making and navigating the development process of the state to new horizons. Such an exercise can also help in identifying the constraints to agricultural development in these areas, and in revealing the success stories. This can contribute in designing appropriate strategies for the balanced agricultural development in the state. **With this background in mind, the present study was designed to achieve the following twin objectives:**

i. To study the spacio-temporal changes in agriculture and its contribution to the state economy.

ii. To measure the level of agricultural development across different districts, identify major constraints and suggest appropriate development strategies.

1.5. Organization of Thesis

The entire thesis is classified into five chapters, namely, introduction; review of literature; materials and methods; results and discussion; and summary and conclusions. The introductory chapter elucidates the main concepts, rationale and objectives of the study. A critical review of the studies done abroad and in India on the related or similar topics is accomplished in the second chapter. The nature of investigation, principal concepts, methods and tools used in the analysis are elaborated in the third chapter. 'Results and discussion' is the fourth chapter wherein the results obtained from data analysis are presented systematically and discussed in a logical and scientific manner to

accomplish the objectives of the investigation. Lastly, a summary of the entire investigation is given in the fifth chapter along with the important conclusions and policy implications derived during the course of the study. The thesis is written in a scientific and conceivable language with appropriate reasoning wherever necessary. Throughout the thesis, due attention has been given to ensure systematic presentation of the topics and to ease comprehension. Tables and figures are used as required in the presentation of results so as to help readers better understand the various topics discussed. For more clarification, certain essential information is given in appendices.

Chapter 2

Review of Literature

Probability of having a good research idea is higher for an investigator with experience and knowledge of the literature.

2. REVIEW OF LITERATURE

Literature review is one of the essential parts of any research project. In today's world, research and development being the essential components of any organization, a large number of research studies have been done on various issues. Virtually, review of literature links the current research project with what has been done in the past. A review of the relevant literature helps in better understanding of the scope, importance and feasibility of the research problem as well as in determining the early research gaps. It is essential in formulating research objectives, questions and hypotheses, and provides the researcher with a theoretical framework because the probability of having a good research idea is higher for an investigator with experience and knowledge of the literature. Similarly, it maximizes the usefulness of research results by integrating them into the similar research topics carried out in the past and gives direction to the research. Keeping this view in mind, a brief resume of research works carried out on various relevant aspects of agricultural development both in India and abroad has been accomplished and documented chronologically under the following broad aspects:

2.1. Trends in Cropping Pattern and Agricultural Diversification

2.2. Trends in Input Use and Employment

2.3. Patterns of Agricultural Development

2.1. Trends in Cropping Pattern and Agricultural Diversification

Chand (1996) investigated the impact of the expansion of area under fruits and vegetables in Himachal Pradesh with a view to provide appropriate perspective of formulating a policy for horticulture in the region. It was observed that the externalities related to fruits and vegetables cultivation in Himalayan region have both positive as well as negative ecological implications and there are ways to tackle those negative effects. The findings also exposed that diversification through horticultural crops resulted in positive externalities such as reduction in cropping intensity, soil erodibility, livestock pressure and grazing incidents, and income improvement all of which have favourable impacts on ecology because low income and poverty are said to be the major causes of natural resources and ecological degradation.

Shiyani and Pandya (1998) examined the levels of crop diversification in different agro-climatic zones of Gujarat over a period from 1960-61 to 1995-96. The findings

reflected that a wide range of spacio-temporal disparities existed in the allocation of area under various crops. Broadly speaking, the farmers shifted their cropping pattern from the subsistence crops to the commercial crops. Relatively, more diversification was observed in the initial years of study as compared to the recent years, in the case of sub-zones 1, 3, 6 and 7 whereas a reverse trend was observed in rest of the sub-zones.

Ram (1999) conducted a study to trace the trends in diversification of cropping pattern in Orissa from 1980-81 to 1993-94. The findings exposed a general move from cereals towards oilseeds, pulses and vegetables. Though, the area under winter and autumn rice during *kharif* and summer rice during *rabi* had increased, the rate of increase was only significant for the latter. Likewise, the departure from other cereals during both *kharif* and *rabi* was seen. However, vegetables have benefitted more from the diversification of the cropping patterns during both seasons.

Saeed (2000) studied the patterns of growth in agricultural production and land use existing in Asian countries and their effects on agricultural resources and food security. The analysis illustrated that agricultural resources are being overstrained and the continuation of such land use policies may lead to widespread decline in agricultural production across the board, thus threatening food security. Similarly, the underlying trends indicated that while the consumption base has expanded across the board through increases in population and income, food production has increased largely via intensive cultivation, but agricultural land resources have mostly stagnated. In some instances, agricultural land under cultivation has increased, but at the cost of a reduction in forest land. The technological solutions to this problem may exist, but these will not be put into practice, unless appropriate social and institutional reforms are introduced to create the incentives for adopting sustainable agricultural practices.

Chand and Chauhan (2002) investigated socio-economic factors affecting agricultural diversification in India. The finding of study clearly showed that agricultural diversification in India has played a crucial role in the growth of agricultural output during last three decades or so. Though agricultural diversification is first motivated by technology or demand driven factors, its success and speed largely depended upon infrastructural factors, availability of resources for acquiring inputs to make use of new production opportunities and structure of land holdings. The study discovered that irrigation, roads network and density of wholesale assembling markets have played key

role in promoting agricultural diversification. It also revealed that higher supply of electricity to agriculture has imparted rigidity to existing cropping pattern and, thus, worked against diversification, but per hectare supply of institutional credit caused desirable impact on diversification.

Dorjee *et al.* (2003) made an assessment of the agricultural diversification trends and constraints in South Asia. The findings of the study declared that the rate at which the commercialization of agriculture occurs varies from continent to continent and from country to country, but the direction of change is the same across the world. In South Asia, the process of income growth accompanied by urbanization has led to a considerable shift in consumption patterns away from cereals towards high-value agricultural products such as vegetables, fruits, oils and fats and livestock products. The flexibility of farmers in responding to diversification opportunities is constrained by the size of markets and price risks, soil suitability and land rights, the availability and quality of irrigation infrastructure and the availability and cost of labour. The study further pointed that significant equity and environmental consequences could arise in the short to medium term unless appropriate policies are followed by the government so as to alleviate many of the possible adverse transitional consequences arising from the process of commercialization and diversification.

Joshi *et al.* (2004) examined the status of agricultural diversification in South Asian countries. The findings of their study revealed that South Asian countries were gradually witnessing agricultural diversification with some degree of inter-country disparities in favour of high value commodities, namely, fruits, vegetables, livestock and fisheries. It was also observed that agricultural diversification is strongly influenced by price policy, infrastructure development (particularly roads and markets), urbanization and technological advancements. Likewise, diversification in favour of horticultural and livestock commodities was seen more in rainfed areas. The evidence confirmed that the regions which were diversifying in favour of non-cereals, achieved high growth as compared to those specializing in cereals. Similarly, agricultural diversification was found to have contributed largely in generating employment opportunities in the sector and augmenting exports.

Jaglan and Thakur (2006) studied changes in cropping pattern of the Bharmaur tribal area of Himachal Pradesh. The study revealed that *Gaddis* have changed their

traditional cropping pattern from cultivating local cultivars towards growing more lucrative crops. These changes were more remarkable for cereals and plantation crops. The area under apple increased from 0.32 per cent of total cropped area during the period 1974-77 to 4.29 per cent during the period 1998-2001. Some of the traditional *kharif* crops viz. *kodra, chinae* and *bhrace* were replaced by cash crops viz. *rajmah* and *urd*. Barley cultivation registered a decline.

Mishra (2007) conducted a study with the purpose to analyze trends in growth of agriculture sector in India during 1951-52 to 1998-99. It was observed that cereals and pulses occupied about 75 per cent ($3/4^{th}$) of the gross area under cultivation. A clear trend (increase) in the percentage area under the cash crops was discernible. Plantation crops occupied a very small percentage (less than 1%) of the total area under crops. Among the food crops, area under wheat had the highest growth rate followed by maize, rice and pulses, in that order. The growth rate of area under millets was negative. Among the major cash crops, area under potatoes had grown the fastest, followed by oilseeds, sugarcane, cotton and jute, respectively. Among the food crops, wheat exhibited the highest growth rate of yield per hectare. Maize and wheat experienced over three-fold increase in the yield while rice demonstrated somewhat less than three-fold increase in the yield. Millets and pulses also showed about 30 to 35 per cent increase in the yield. Introduction of high yielding varieties (HYVs) seeds of wheat, maize and rice coupled with improved irrigation facilities led to the said spectacular increase in the yield of these crops. Among the major cash crops, cotton, sugarcane and jute exhibited two-fold increase in their yield. Results of decomposition analysis of agricultural growth revealed that the percentage contribution of change (increase) in yield is the most dominant component of agricultural growth. The percentage contribution of change (increase) in the gross area under cultivation was the second most influential factor of agricultural growth while change in cropping pattern was observed to be only a marginal component of agricultural growth.

Mondal (2008) examined the effects of change in land use on livelihood pattern of small farmers in Khulna District of Bangladesh. The study identified that there has been a considerable change in agricultural land use in the study area as a result of which about 46.26 per cent of the total land has moved from sole agriculture to agro-shrimp farm during the study time from 1970 to 2006. Before this, the small farmers were involved in crop agriculture and were only fully engaged in work during harvesting period of paddy over the year. Thus, the scope of employment opportunity and working hours has changed

with changes in land use. At the same time, some families having no plot of agricultural land got access to income generating activities over the year that led to changes in income pattern of people.

Jha *et al.* (2009) examined crop diversification pattern in India. The study delineated that agricultural diversification as measured by increase in the share of area under non-food crops has grown whereas agricultural diversification in the context of concentration indices remained unchanged during the recent decade. Conspicuous changes were observed in the pattern of agricultural diversification at the regional level. Pockets of specialization in certain crops and crop groups have emerged within a region. Furthermore, changes in the share of gross cropped area also suggested a move towards specialization because there has been a significant increase in the share of gross cropped area under fruits and vegetables. The micro-level findings of the study suggested that certain crops were more remunerative in the given resource endowments and institutional framework. Farms in the region were getting specialized under these crops and such specialization has not increased the risk.

Mehta (2009) investigated how farmer's decision regarding area shift in favour of high value crops (fruits and vegetables) is affected by factors such as, price of product, farmer's income and object of food security in Shimla district of Himachal Pradesh. The results revealed that higher food requirements of farmer's family prevented crop substitution decision of the farmers. Nevertheless, both apple and vegetable farmers were less responsive to the changes in the prices of foodgrains (in terms of changing their consumption) because high income from high-value crops gave them enough money to purchase food crops from the market. Likewise, it has been identified that it is the relative income (not relative price) of the crops which explained the crop substitution decision of the farmers. It was reported that farmers take into account the total returns from the crop rather than calculating merely the price of the crop while making the decision to shift. Similarly, it was found that the replacement decision is influenced by farmer's capacity to generate higher productivity along with better market prospects.

Shome (2009) analyzed crop diversification in the Asia-Pacific region with an object to examine various facets of crop diversification and the way it is happening in Asia-Pacific region over the last decade. The results of this study showed that considerable crop diversification has occurred during the past few years but the level of success varied

from country to country. In spite of remarkable progress achieved in crop diversification, there is need for further promoting it on scientific lines and to realize its untapped potential. It was identified that the essential principle of all successful diversification programmes was that these were driven by market potential.

Siebert *et al.* (2010) conducted a global scale analysis on cropping intensity, crop duration and extent of fallow land. The results of the research revealed that the magnitude of fallow land was large, except in developed countries settled in temperate climate zones. There existed huge disparities in land use intensity on cropped land even under similar climate conditions, ranging from extensive shifting cultivation with decade-long period of fallow to extremely intensive multi-cropping in tropic regions. Likewise, the lowest cropping intensities were found for southern Africa (0.45), Central America (0.49) and Middle Africa (0.54), while the highest cropping intensities were computed for Eastern Asia (1.04) and Southern Asia (1.0). In remote or arid regions where shifting cultivation was a usual practice, fallow intervals lasted 3-10 years or even longer. Conversely, crops were harvested two or more times per year in highly populated and often irrigated tropical or subtropical lowlands where multi-cropping practices were frequently used.

2.2. Trends in Input Use and Employment

Singh and Nadda (1995) conducted a study on the use of modern inputs in hill agriculture, in Himachal Pradesh. The findings showed that the use of HYV seeds in maize, wheat and paddy crops at state level increased by about 51, 27 and 33 per cent, respectively, during 1978-79 to 1992-93. During this period fertilizers consumption increased from 10.56 kg/ha to 40 kg/ha of gross cropped area. The area covered under plant protection measures increased from 0.23 per cent to 0.45 per cent of gross cropped area in the state. The use of modern farm machinery and implements was relatively more in low hill zone as compared to mid and high hill zone of the state. Large gap was observed in the use of seeds, fertilizers and manure between actual and recommended rate in cultivation of maize, wheat, paddy and potato.

Kearney (2000) analyzed the perspective of agricultural labour force in the context of both Ireland and Europe. The study observed that the most striking aspect of agricultural employment has been its inexorable decline both in absolute and relative terms. The two sets of factors i.e. push and pull, influence employment in agriculture which are likely to remain strong for foreseeable future. The crucial factors influencing employment in

agriculture were largely exogenous to the sector and have tended to reduce the number of people engaged in agriculture. The study suggested that the falling trend of employment is not only because the farmers are leaving their farming profession to work elsewhere in other sectors, but it is mainly due to the combined effects of reduced entry and retirement. In Ireland, farm labour force could decline more sharply if the economy continues to grow strongly and prospects in the farm sector remained discouraging.

Jha (2006) examined the status of employment, wages and productivity in Indian agriculture. The findings suggested that employment in agriculture remained almost stagnant during 1990s, but it declined in the sub-sectors of livestock, forestry and fishery. As a whole, employment in agriculture and allied activities declined in many states while in certain states it increased but the trends were, however, not encouraging. Push as well as pull factors were said to be responsible for this spatial downwards trend in employment. The share of female works in agriculture has increased at aggregate level, although it has decreased in some of the states. In certain states male workers were observed to surpass the female workers in agriculture.

Mrema *et al.* (2008) investigated agricultural mechanization in Sub-Sahara Africa (SSA) with a purpose to provide evidence for a new look into the issue. They described that over the past three decades not only has progress stalled in agricultural mechanization in much of the Sub-Sahara Africa, but the progress attained in the earlier years is being lost in many parts of the continent. Tractor hire services have declined. Furthermore, because of droughts and decimation of livestock herds by the outbreaks of diseases, some of the regions which relied on draught animal technology reverted back to hand hoeing. In 1961 Sub-Sahara Africa had 2.4, 3.3 and 5.6 times more tractors in use than Brazil, India and China, respectively, but in 2000 the case reversed its trend, India, China and Brazil had 6.9, 4.4 and 3.7 times more tractors in use than the entire Sub-Sahara Africa including South Africa. Further, the tractors in use in Sub-Sahara Africa in 2000 were concentrated in a few countries i.e. 70 per cent in South Africa and Nigeria. It was estimated that in 2000 the primary land preparation activities on 80 per cent of the cultivated land in Sub-Sahara Africa would rely on human muscles power whereas only 15 per cent and 5 per cent would be performed by draught animals and tractors, respectively.

Nisha (2008) conducted an economic analysis of women employment in agriculture, in Palakkad district of Kerala State. It was found that women labourers got

maximum employment during *kharif* and *rabi* seasons. They got full employment mainly during the agricultural operations of weeding, harvesting and post harvest operations. They received their wages in cash for all the operations except for harvest and post harvest operations. The women labourers had maximum unemployed days during summer as this is off season for agriculture in the study area. This compelled women labourers to seek alternative employment sources out of agriculture and earn income. Such seasonal unemployment also caused migration of labourers to other activities and places.

Alvarez-Cuadrado and Poschke (2010) analyzed the relative role played by agricultural and non-agricultural productivity in the process of structural change. The study used U.S. time series since 1800 and a sample of 11 industrialized countries starting in the 19th century with the aim to find out the relative importance of the two channels (labour push vs. labour pull) in structural transformation. The study concluded that the declining employment share of agriculture was a key feature of economic development which is caused by improvements in agricultural technology combined with Engel's law, releases resource from agriculture (labour push), and improvements in industrial technology attract labour out of agriculture (labour pull). The findings suggested that, the "pull" channel dominated until about World War II, with "push" channel dominating afterwards i.e. it followed "first pull than push channel." The "pull" channel mattered more in countries in early stages of the structural transformation.

2.3. Patterns of Agricultural Development

Desai and Patel (1983) examined the growth rate of output of major foodgrains (rice, wheat, bajra, and jowar) in four states of western zone during the period 1965-66 to 1981-82. They found that there were variations in growth rates of outputs within a state as well as among the states. Growth rate of wheat was much higher than that of rice in all four states and in the western zone. It was highest in Rajasthan followed by Maharashtra and Gujarat. In case of output growth rate of rice, Rajasthan recorded the highest growth followed by Maharashtra, Gujarat and Madhya Pradesh. The overall tendency for the decline in growth rate of area was seen in all states except Gujarat where rate of decline had slowed down.

Bhalla and Tyagi (1989) investigated spatial pattern of agricultural development in India. The results revealed that with the adoption of new seed-fertilizer technology, agriculture in major part of India had undergone significant transformation. During 1962-

65 to 1970-73, the Green Revolution was restricted only to a few north-western states, but it showed a gradual extension to many other parts of India during the seventies, although this extension was much narrowly confined. Some negative features of this growth were noted as major eastern states continued to have very low rates of growth in agricultural output, which were lower than the growth rate of population and even male workforce. The performance of Tamil Nadu had deteriorated quite significantly and the fluctuations in agricultural output continued to be very large in the central states like Maharashtra, Rajasthan and Madhya Pradesh. These negative features had primarily risen because of lack of adequate investment in irrigation and other rural infrastructure. It was noticed that high level of yield as well as high growth rates were primarily associated with high use of modern inputs and that high use of modern inputs was dependent on availability of assured irrigation.

Prabhu and Sarker (1992) conducted a study to identify the levels of development across various districts of Maharashtra state. The results of study demonstrated a clearcut ranking of the districts in Maharashtra both at the sectoral as well as aggregate levels. In the final ranking, 11 districts were identified to be highly developed while 3 were put as those which achieved middle level of development and the rest 15 districts were classified as underdeveloped. The persistence of wide disparities in the level of development of various regions in Maharashtra despite a quarter century of planned economic development was upsetting and indicated the need for urgent remedial measures.

Chandrashekar and Ninan (1993) analyzed the growth experience of Indian agriculture and its implications for growth, equity and sustainability. They observed that while irrigated crops and those with access to modern farm technology have dominated the growth process, dry crops and drought prone regions like Karnataka in south India too had shared the gains in agricultural growth. But this growth process had been accompanied by higher instability in yields and increasing cost of cultivation.

Sawant and Achuthan (1995) undertook a study to analyze agricultural growth across crops and regions with a purpose to understand the emerging trends and patterns. The study was confined to the post green revolution phase for the period 1967-68 to 1992-93. The investigation delineated that there had been a significant increase in the production and productivity growth in Indian agriculture in recent years and it cannot be attributed merely to a favourable weather. Further, the important role played by yield improvement in

inducing higher growth in output depicted that the process of growth has been technological dynamic. The growth was observed to be wide spread across crops and regions more so in the 1980s.

Bhalla and Singh (1997) conducted a study to trace the recent developments in Indian agriculture. They analyzed data on area and output of 43 crops for the period from 1962-65 to 1992-95. The findings showed that there was a considerable acceleration in the growth rate of agricultural output in India during 1980-83 to 1992-95 as compared to the earlier periods. Further, agricultural growth had become regionally much more diversified. The period 1980-83 to 1992-95 was also characterized by important changes in cropping pattern away from coarse cereals towards rice and wheat cultivation on the one hand and towards oilseeds on the other. Finally, the 1980s also witnessed a widespread acceleration in per male agricultural worker productivity in many Indian states. The study suggested that, high labour productivity growth, if sustained, is likely not only to result in higher wages but also to trigger growth in the non-agricultural sector through input-output and consumption linkages.

Sardana *et al.* (1997) undertook a study of growth and variations in agricultural performance of Haryana. The findings showed that the disparities in agricultural performance in terms of value of agricultural product per hectare have decreased among the districts in the state. The potential for growth with the existing technology was observed to lie in the backward districts alone. In addition, the study suggested that dependence of agriculture on high yielding varieties (HYVs) and fertilizer consumption which are the core determinant of growth in agriculture, has reduced overtime. But stagnation in dependence on these inputs has started becoming visible in already developed districts.

Sharma *et al.* (1997) conducted a study with the purpose of analyzing disparities in agricultural development of the mountainous states of India. They observed a wide range of discrepancies in agricultural development among the mountainous states. The gross cropped area ranged from 74000 hectares in Mizoram to nearly 3.8 million hectares in Assam. In the same way, the gross irrigated area demonstrated a wide range perhaps due to infrastructural facilities available in these states. The fertilizer consumption per hectare in the northern mountainous states viz. Himachal Pradesh and Jammu & Kashmir was much higher than their counterpart states in the east except Manipur, although it was low as

compared to the national average. The results further showed a direct relationship between the cultivated area and area under high yielding varieties (HYVs). But as per hectare of cultivated area, northern mountainous states had an edge over the eastern states except Manipur. Productivity of rice was the highest in Jammu & Kashmir while that of wheat and maize was the highest in Himachal Pradesh. Furthermore, productivity of oilseeds was the highest in Sikkim while that of pulses was the highest in Mizoram. A wide range of disparities in productivity were observed among different mountainous states of India. Factors like, topography, climate, accessibility, economic background of the population and socio-economic features were found to be responsible for the productivity variations in these states.

Singh *et al.* (1997) analyzed the regional variations in agricultural performance in India. The findings clearly showed that the yield of total foodgrains as well as individual foodgrain crops have witnessed higher growth rates as compared to acreage in the last two decades. At state level, Bihar, Haryana, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttar Pradesh performed much better than the other states. The growth rates of yield were much more impressive than those of production in these states. In case of non-foodgrain crops, oilseeds maintained steady trend in growth rates during the last two decades. The states of Gujarat, Karnataka, Maharashtra and Tamil Nadu although experienced stagnation in the growth rate of sugarcane production, yet the growth rates for these states were higher than those of other states. Cotton maintained an increasing trend in its production and yield growth rates over the years at the national level. In case of individual states, Haryana, Punjab, Rajasthan and Karnataka maintained impressive growth rates in the production and productivity of cotton. The findings further revealed that increased use of irrigation water, fertilizers and high yielding varieties (HYVs) seeds could further increase the yield of foodgrains crops in most of the states. The main determinants of agricultural performance were found to be the total cropped area, yield per hectare and irrigation water, closely followed by regulated markets and road networks.

Bhide *et al.* (1998) examined patterns of variations in growth rates of the components of agriculture both at national as well as state levels using net state domestic product from agriculture for the period from 1950-51 to 1993-94. It was concluded that unlike non-agricultural sector, growth in agriculture has been steady for almost four decades since 1950 and statistical tests showed no structural break in the growth pattern of agriculture. As far as trend of growth in output per hectare was concerned, structural

breaks occurred in the mid 1960s and in 1980s. Growth rates in agriculture exhibited significant cyclical pattern both at crop as well as state levels. The crop level cyclical pattern was attributed to movements in relative prices or other factors related to market conditions, whereas the state level cyclical pattern was expected to be related to policies. The patterns of growth rates of agricultural output of states exhibited a tendency to converge to a single rate of growth in the short run but in the long run there were two divergent patterns; states with higher proportion of crop area under irrigation tended to converge to higher rate of growth whereas states with lower proportion of crop area under irrigation inclined to lower rate of growth.

Sharma *et al.* (2003) investigated the overall status of horticulture specially apple farming in Himachal Pradesh. It was found that over the years, the state of Himachal Pradesh has made significant progress in the horticultural farming due to its favourable agro-climatic conditions and active government back up in terms of infrastructure development, support prices, input subsidies, institutional development, etc. The study showed that the accomplishments in fruit farming have put the state at the top position in the horticultural map of India and the state has come to be known as "Apple State of India".

Bhattacharya and Sakthivel (2004) analyzed the growth and disparities among major states of India during the pre and post reform periods. The results revealed that while the growth rate of gross domestic product has improved only slightly in the post-reform decade, regional disparities in the state domestic product have widened more severely. Industrial states are now growing much faster as compared to backward states and there was no evidence of convergence of growth rates among states. Similarly, an inverse relationship was observed between population growth and state domestic product growth which has serious implications for employment and political economy of India.

Kant (2005) analyzed agricultural development in Himachal Pradesh in terms of three main components viz. inputs, output and agricultural diversification. The results revealed that irrigation extent is limited and nearly stagnant in the state. The special disparities in irrigation extent and irrigation intensity were observed to be increasing. Furthermore, cropping pattern was shifting towards fruits and vegetables in the higher and Trans-Himalayan Zones whereas in the lower and Outer Himalayan Zones it was shifting towards cereal crops. The inter-district disparities in the level of agricultural development

have not widened for the study period which was attributed to the progressive decline in agricultural development of more developed districts.

Sharma (2005) studied agricultural development in Himachal Pradesh to understand the patterns, process and factors that facilitated the process of agricultural development and crop diversification in the state. From the findings of his study it comes out that agriculture in Himachal Pradesh recorded relatively high growth during the past three decades, especially in the eighties. The yield levels of various crops had also increased over the period by varying degrees. Similarly, the horticulture sector registered considerable increase in terms of area and production of fruits. Also, the process of crop diversification that emerged in the state since eighties, was, however, more remarkable in the districts/areas enjoying favourable agro-climatic conditions. The findings also showed that the net returns from various cash crops were very high compared to traditional field crops. It was concluded by the study that agricultural development and diversification in the state was largely connected to huge infrastructural investments, active promotion of marketing arrangements, credit facilities, technological innovation, extension services and storage network.

Ghosh (2006) examined the regional disparities in agricultural development across 15 major states during 1960-61 to 2001-02, with a purpose to trace the direction of changes in regional disparities of agricultural development due to the economic reforms and dissemination of new agricultural technology in India. Three different methods were used to measure these disparities. The estimates of absolute β-convergence revealed that while there has been no significant convergence or divergence in land productivity and per-capita agricultural output, there has been remarkable divergence in labour productivity, especially after the commencement of the economic reforms in early 1990s. In addition, the results of σ-convergence showed that although inter-state disparities in land productivity decreased over time after the introduction of HYV technology, labour productivity and per-capita agricultural output increased considerably. Likewise, the estimates of β-convergence showed sizeable inter-state variations in the steady-state levels of land and labour productivity and per-capita agricultural output, implying that the regional disparities in agricultural development have been largely due to these variations. According to this study the variations in steady-state levels of the three measures of agricultural development could be largely due to variations in human capital, physical capital and rural infrastructure across the states and the persisting regional disparities in agricultural performance have

been largely due to inter-state variations in the steady-state levels of land and labour productivity and per-capita agricultural output.

Narayanamoorthy and Hanjra (2006) studied the nexus between infrastructure development and agricultural output across 256 districts drawn from 13 states at three points of time, 1970-71, 1980-81, and 1990-91. Both descriptive and regression analysis were used for the purpose. The descriptive analysis showed that the districts whose value of agricultural output is above the average were situated at better position in terms of rural infrastructure compared to other districts. Likewise, the univariate regression analysis showed that except rural electrification, the remaining three infrastructure factors (irrigation, roads and literacy) considerably explained the variation in output for all the three time points. The multivariate regression analysis revealed the pivotal role of rural roads in increasing the value of output, followed by literacy and irrigation during 1970-71, whereas irrigation played a dominant role in 1990-91. The study, therefore, established strong relationship between rural infrastructure development and value of agricultural output. It also pointed out the fact that large inequalities exist in rural infrastructure among the districts studied.

Sharma *et al.* (2006) conducted a study with the object to analyze the extent and source of instability in foodgrains production in India. The results demonstrated an increase in average production of major foodgrain crops, viz. rice, wheat, maize, *bajra* and pulses and total foodgrains in the nineties over eighties. The decomposition of changes in average production further revealed that increase in mean yield was the most important source of increase in the average production of individual crops as well as total foodgrains. The notable exceptions were *jowar,* small millets and *ragi* where increase in area was an important source of increase in average production. Furthermore, among the individual crops rice contributed nearly three-fifth of the total increase in foodgrains production followed by wheat and maize with respective shares of around one-third and one-tenth. Among states, Punjab, West Bengal, Haryana, Madhya Pradesh and Bihar were important contributors towards increase in the production of total foodgrains. The production of individual crops including total foodgrains had become more stable in the nineties as compared to that in eighties. The change in variance of yield accounted for 97 per cent of the total decrease in the variability of foodgrains production. The changes in yield variance and interaction between changes in mean area and yield variance accounted for nearly whole of the per cent change in the variance of total foodgrains production. Among crops

change in the variance of wheat production was the most important component accounting for nearly whole of the change in the variance of total foodgrains production and the decrease in the variance of foodgrains production was largely, *inter alia*, contributed by Uttar Pradesh.

Tuteji (2006) undertook a study to analyze the growth performance in terms of area, production and yield of pulse crops in India. It was found that the all India pulse production grew at the rate of 0.7 per cent per annum during 1980-81 to 2001-02. The growth in area was found almost stagnant whereas yield increased at a slow rate of around 1 per cent. Pulse production growth pattern varied widely across the major pulse growing states. The growth in production occurred due to area and yield in three states but yield was the major contributor in Tamil Nadu and Madhya Pradesh. Further, the pre-economic reforms period with 1.9 per cent per annum growth in pulse production was far better than the post-reforms period with negative growth of 0.3 per cent per annum. Among other pulses, *masar (lentil)* emerged as the fastest growing crop in production due to area as well as yield. The results also revealed that acreage allocation in *rabi* pulses i.e. gram and *masar* got influenced by lagged acreage followed by relative price in most of the analyzed cases. This judgment, however, does not apply to *kharif* pulses. In allocating land to *arhar*, *moong* and *urad*, farmers considered lagged acreage and magnitude of pre-sowing rainfall as the most important factors.

Bhatia and Rai (2007) evaluated agricultural development in Asian countries. The analysis of 39 countries out of fifty Asian countries showed that China is the highly developed while Bhutan is the least developed country in terms of agricultural development. Agricultural development is found to be highly associated with the productivity level of wheat and rice. Wide disparities have been observed in the level of agricultural development across the Asian countries under study.

Kumar (2007) conducted a study on development disparities in Himachal Pradesh with an object to capture different levels of development at disaggregated level of the districts during 1991-2001. The findings revealed that the process of development has been more favourable to high hill districts compared to mid and low hill districts. The tribal districts have witnessed considerably more development during the study period while the overall disparities in development across the districts appeared to be on a converging mode. However, those with respect to very few indicators were found to be diverging.

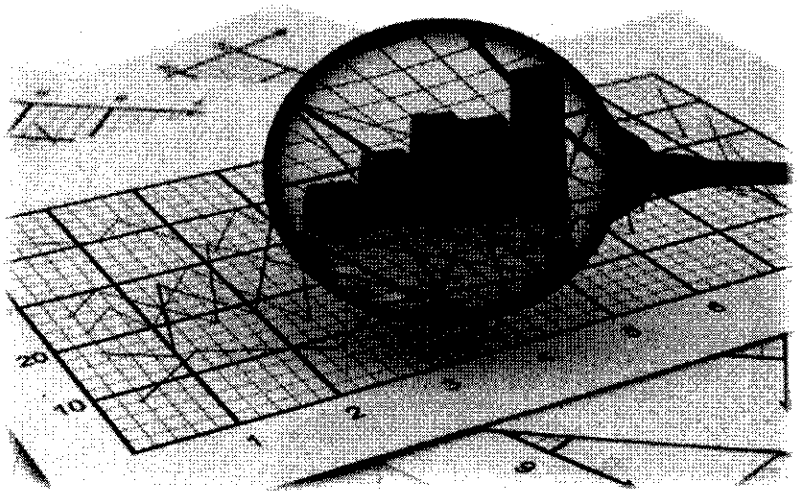
Chand *et al.* (2009) examined regional variations in agricultural productivity at disaggregated level of districts in India. The findings demonstrated large variations in agricultural productivity across districts in the country. Generally, low productivity districts were characterized by low rainfall, low irrigated area and lesser use of fertilizers. Hence, fertilizer use, rainfall and irrigation were found to cause discernible variations in productivity across districts. The highest coefficient was for rainfall (0.43), followed by fertilizer consumption (0.27) and irrigation (0.11). Another interesting finding of the study indicated the importance of agricultural productivity in rural poverty reduction; that is a one per cent increase in land productivity reduces rural poverty by as much as 0.51 per cent. The effects of the agricultural labour were found to be reverse; that is a one per cent reduction in agricultural labour reduces rural poverty by 0.49 per cent. However, most of the districts that were in low or very low productivity range were observed to offer immense opportunities for raising agricultural production in the country.

2.4. Contribution of the Study

The review of literature revealed that several studies have been carried out to sketch out various dimensions of agricultural development in the state (Mehta 2009; Kumar 2007; Sharma 2005; Kant 2005; Sharma *et al.* 2003; Chand 1996; Singh and Nadda 1995; etc.). However, these studies were mainly confined to the state level analysis and covered a few dimensions of agricultural development. Land use, cropping pattern, production and productivity changes were common aspects discussed therein mainly at the state level and over a short period of time. Trends in input use, irrigation extent, mechanization, agricultural employment, etc., which are crucial to agricultural development have not been studied at the disaggregated level of districts for longer time periods. Most importantly no study attempted determining the levels of agricultural development and measuring the disparities in agricultural development at the district level. Hence, the need for conducting a comprehensive and inclusive study on agricultural development in the state was obvious. Therefore, in order to trace the recent changes and developments that have taken place in agriculture sector of the state, the present study was designed to measure agricultural development at both the state as well as disaggregated level of districts.

Chapter 3

Materials And Methods



Researchers are making figures speak by changing them into information through appropriate statistical and econometric techniques.

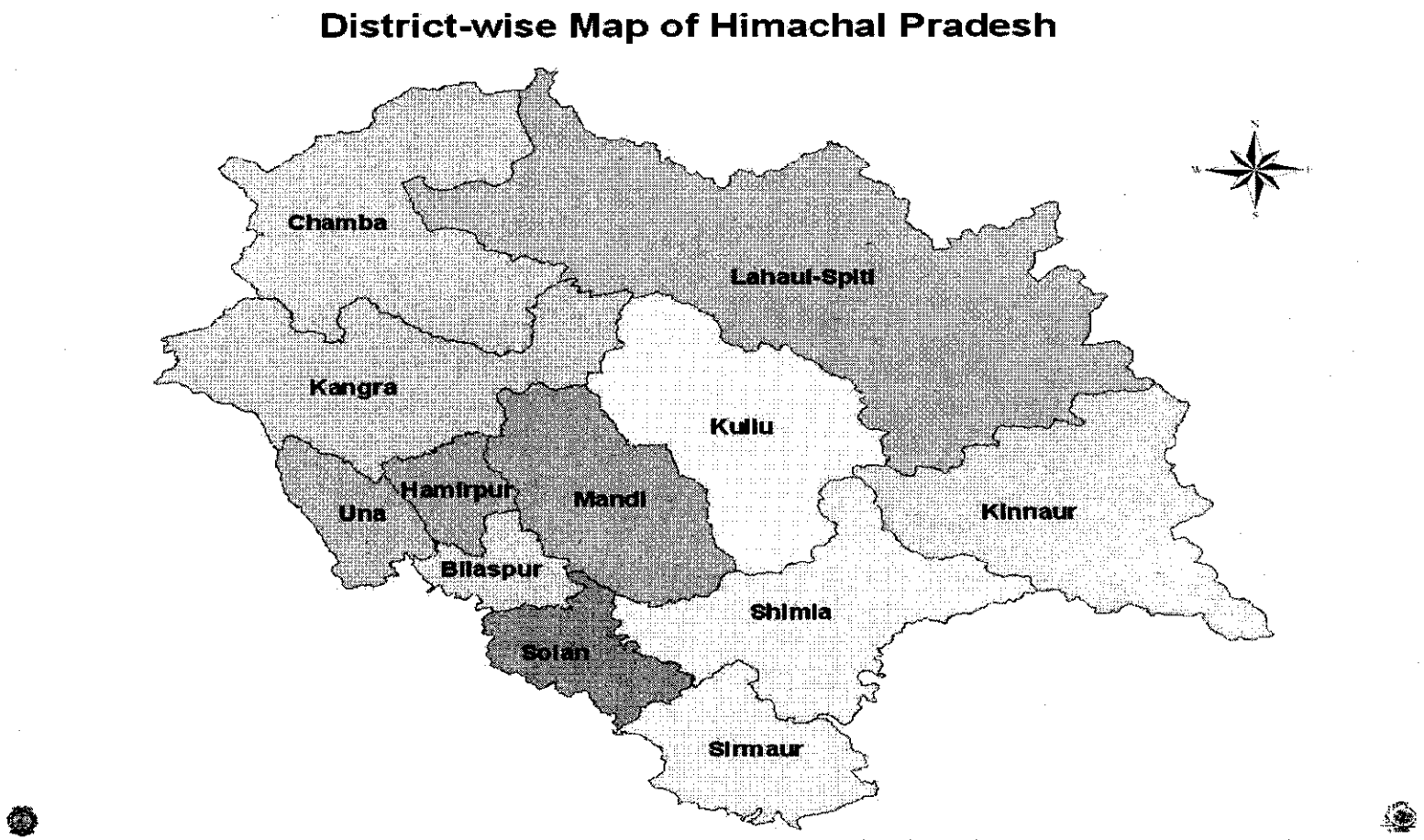
3. MATERIALS AND METHODS

One of the basic parts of any research is the description of methods and means used in the process of investigation to produce results. Selection of accurate methods for analysis of appropriately collected data helps in increasing the precision and reliability of the research findings. A description of the materials and methods used in data analysis will help readers to understand the procedure with which the results are obtained. Similarly, it will give insight to researchers willing to conduct studies in the same or related fields in designing research methods and determining data requirements. Therefore, this chapter is devoted to describe in detail the tools and materials that have been used in the present study. It is summarized under the following headings:

3.1. Scope of the Study

Time and budget are, *inter alia*, the main limiting factors in any research project. Therefore, the researcher has to define the scope of the research project in the light of time and financial resources at one's disposal. Hence, the present study was geographically confined to the state of Himachal Pradesh encompassing its twelve districts, viz., Bilaspur, Chamba, Hamirpur, Kangra, Kinnaur, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmaur, Solan and Una, as the ultimate units of analysis (*see Fig. 3.1*). Due to the constraint of data availability, the time span of the study was not the same for all the indicators but it generally covered the recent three to four decades. However, in this study an attempt has been made to capture the changes that have taken place in the agriculture sector; to gauge its contribution to the state economy in terms of product contribution and employment; and to measure the levels of agricultural development across districts, identify major constraints and come out with appropriate development strategies for the agriculture sector.

Fig. 3.1 District-wise Map of Himachal Pradesh (Study Area).



3.2. Data Collection

The study is based on secondary data. Time-series data at the district as well as state level were collected for a number of agricultural development indicators, namely, land use, production of major crops and crop groups, area under major crops and crop groups, net and gross irrigated area, fertilizer consumption, area under high yielding varieties, land holdings, agricultural implements, gross state domestic product (GSDP), employment, etc. Data on land use, agricultural implements and size of holding were collected from various issues of *Statistical Outline of Himachal Pradesh,* a publication of the *Directorate of Economics and Statistics, Shimla-9, Government of Himachal Pradesh.* Data on area and production of major crops and crop groups and area irrigated (net and gross) were taken from various issues of *Annual Season and Crop Report published by Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.* Data pertaining to fertilizer consumption were taken from various issues of *Fertilizer Statistics, The Fertilizer Association of India, New Delhi.* Data concerning employment were obtained from *Primary Census Abstracts, Census of India 1981, 1991 and 2001* as well as from various issues of *Statistical Outline of Himachal Pradesh.* Data on gross state domestic product (GSDP) at constant prices were taken from the official website *(Central Statistics Office) of Ministry of Statistics and Programme Implementation, Government of India.*

3.3. Concepts and Definitions

An explanation of the main concepts used in the research pursuit is crucial in better understanding of any study as it provides a clear-cut meaning of the concepts used in the text to the readers. Hence, the core concepts used in the present study are explained below.

3.3.1. Land Use Categories

i. **Forests Lands:** All actually forested area on lands classed or administered as forests, covered by any legal enactment dealing with forests, whether state owned or private, whether wooded or maintained as potential forest land, comes under the category of forests.

ii. **Barren and Unculturable Lands:** It includes all barren and unculturable lands like mountains, deserts, etc. which cannot be brought under cultivation except at an exorbitant cost. These lands can lie in isolated blocks or may lie within cultivable holdings.

iii. **Land Put to Non-Agricultural Uses:** This category includes all lands which are put to uses other than agricultural viz. lands occupied by buildings, roads, railways, rivers and canals, etc.

iv. **Permanent Pastures and Other Grazing Lands:** This includes all grazing lands whether they are permanent pastures or not. The village common grazing lands are included under this head.

v. **Land under Miscellaneous Tree Crops:** This includes all such lands which are not included in Net Sown Area but these are put to some agricultural uses. It includes lands under miscellaneous trees i.e. land under *casuarina tree, thatching grasses, bamboo* bushes and other groves for fodder/fuel purposes.

vi. **Net Sown Area:** This represents the net area sown under crops counting area sown more than once only once in the same year.

vii. **Total Cropped Area/ Gross Cropped Area:** It is the sum total of all area sown under all crops during the year under review counting areas sown more than once separately for each crop.

viii. **Culturable Waste Lands:** This comprises all lands available for cultivation whether taken up for cultivation or abandoned after a few years for one reason or the other. Such lands may be either fallow or covered with shrubs or jungles, which are not put to any use. Land once cultivated but not cultivated for five years or more in succession shall be included under this head.

ix. **Other Fallow Lands:** This includes all lands which were taken up for cultivation but are temporarily out of cultivation for a period not less than one year or not more than five years.

x. **Current Fallows:** This represents cropped areas which are kept fallow during the current year. For instance, if any seeding area is not cropped again in the same year, it may be treated as current fallows.

3.3.2. **Cropping Intensity**

Cropping intensity is an index measuring the intensity of cultivation which indicates the efficiency of land utilization. It is defined as the ratio of gross sown area to net sown area, and for convenience it is multiplied by hundred to show it in

per cent. Hence, it is the ratio of gross sown area expressed as percentage of net sown area. Mathematically it can be expressed as follows:

$$Cropping\ Intensity\ (\%) = \frac{Gross\ Sown\ Area}{Net\ Sown\ Area} \times 100$$

3.3.3. Irrigation Intensity

Irrigation intensity is a parallel concept to cropping intensity measuring the intensity of irrigation. It is defined as the ratio of gross irrigated area expressed as percentage of net irrigated area. Mathematically it can be expressed as follows:

$$Irrigation\ Intensity\ (\%) = \frac{Gross\ Irrigated\ Area}{Net\ Irrigated\ Area} \times 100$$

3.3.4. Irrigation Extent

The term irrigation extent is defined in the present study as the ratio of net irrigated area expressed as percentage of net sown area. Mathematically it can be expressed as:

$$Irrigation\ Extent\ (\%) = \frac{Net\ Irrigated\ Area}{Net\ Sown\ Area} \times 100$$

3.3.5. Productivity or Yield

Productivity is an important indicator measuring the efficiency of cultivation or yield per unit of land. Generally, it is defined as the ratio of output per unit of input used in production. Often when productivity is discussed in agriculture, we mean productivity of land or efficiency of cultivation. In this context productivity can be defined as the ratio of total output to the total area of land from which the output is obtained. Mathematically it can be expressed as follows:

$$Productivity/Yield = \frac{Total\ Output}{Total\ Area\ of\ Land\ Used}$$

3.3.6. Agricultural Diversification

Agricultural diversification is one of the frequently used concepts in the discussion of agricultural development. Traditionally, the term agricultural diversification was used to describe a subsistence kind of farming wherein farmers

grew a number of crops on their farms. In the recent decades especially after the trade liberalization in 1990s, agricultural diversification was used to describe increase in area under high value crops. More generally, diversification could suggest one or all of the following three situations:

a) A shift from farm to non-farm activities,
b) A shift from less profitable crop or enterprise to more profitable crop or enterprise, and
c) Use of resources in diverse but complementary activities (Vyas 1996).

3.3.7. **Work Participation Rate (WPR)**

Work participation rate (WPR) is a crucial concept in understanding of what per cent of the total population is actively working in different activities. It is defined as the percentage of total workers (main and marginal) to total population. Mathematically it can be expressed as follows:

$$Work\ Participation\ Rate\ (WPR) = \frac{Total\ Workers\ (Main + Marginal)}{Total\ Population} \times 100$$

where, those workers who had worked for the major part of the reference period (i.e. 6 months or more) are termed as *Main Workers* and those workers who had not worked for the major part of the reference period (i.e. less than 6 months) are termed as *Marginal Workers*. Nevertheless, in the present study this concept is used in the context of agriculture sector and is termed as agricultural work participation rate (AWPR) wherein in place of total main and marginal workers only those main and marginal workers engaged in agriculture are expressed as percentage of total population.

3.3.8. **Gross State Domestic Product at Constant Prices (Real GSDP)**

Gross state domestic product at constant prices or real GSDP is used as a handy measure of the economic growth. Real gross state domestic product (real GSDP) is defined as the total market value of all final goods and services produced in the state's economy during a year and are valued at constant or base year prices.

3.3.9. Gross state domestic product originating from agriculture at constant prices (Agricultural GSDP)

Gross state domestic product originating from agriculture at constant prices denotes the total money value of all final goods and services produced in the state's economy by the sub-sector of agriculture during a year and are valued at constant or base year prices.

3.3.10. Agricultural Employment

Agricultural employment in the context of the present study describes the sum total of cultivators and agricultural labourers engaged in agriculture.

i. **Cultivator:** A person is classified as cultivator if he or she is engaged in cultivation of land owned or held from government or held from private persons or institutions for payment in money, kind or share. Cultivation includes effective supervision or direction in cultivation.
ii. **Agricultural Labourer:** A person who works on another person's land for wages in money or kind or share is regarded as an agricultural labourer. She or he has no risk in the cultivation, but merely works on another person's land for wages. An agricultural labourer has no right of lease or contract on land on which she or he works.

3.3.11. Mechanization Extent

The term mechanization extent is used in the present study to denote the sum total of tractors, threshers, electric pumps and oil engines per one thousand hectares of gross cropped area.

3.3.12. Agriculture

Broadly speaking agriculture means growing and/or raising crops and livestock. However, in the context of present study except for gross state domestic product it is generally used to denote only crop production.

3.4. Analytical Framework

For better understanding, the analytical framework of the present study is divided into two main parts, namely, *indicators of analysis and tools of analysis* which are discussed in this section one by one.

3.4.1. Indicators of Analysis

The present study was designed to achieve the twin objectives, namely, to study the spacio-temporal changes in agriculture and its contribution to the state economy and to measure the levels of agricultural development across different districts, identify major constraints and suggest appropriate development strategies.

For achieving the first objective indicators such as *land use, production, productivity, cropping pattern, cropping intensity, irrigation intensity, extent of irrigation, agricultural diversification, holding size, extent of mechanization, fertilizer consumption, area under high yielding varieties, agricultural employment, work participation rate in agriculture and gross state domestic product at constant prices* were analyzed for spacio-temporal changes at both districts as well as state level except for *area under high yielding varieties, extent of mechanization and gross state domestic product* which were analyzed only at the state level because of limitation in the availability of data.

To achieve the second objective a set of fifteen standard indicators of agricultural development were selected in the light of the extensive literature reviewed and objectives of the study. Selection of the indicators was also subject to limitation in data availability. The 15 selected indicators were further divided into two groups, viz., positive indicators and negative indicators. Among them the first 13 were positive whereas only the last 2 were negative indicators. Positive indicators consider maximum value of an indicator as the best performance and minimum value of an indicator as the worst performance. Contrary to this, negative indicators consider the maximum value of an indicator as the worst performance and the minimum value of an indicator as the best performance. Table 3.1 provides details about the indicators selected for the present study (*detailed information is given in Appendix 1 & 2).* The levels of agricultural development were then determined on the basis of three methods separately, viz., ranking method, indexing method and agricultural development index (ADI) method. The districts were then

classified into two broad categories, namely, more developed districts and less developed districts. For this, median of the aggregate scores was calculated and the districts whose aggregated scores for all the three methods were equal to or above median were classified as more developed districts and those securing aggregate scores less than median were classified as less developed districts. Major constraints to agricultural development in the state and districts were identified in the light of the results obtained in the course of the study. At the end, appropriate development strategies are suggested for tackling the constraints faced by agriculture both in the state as well as the districts.

Table 3.1 Selected Agricultural Development Indicators.

Sr. No.	Indicator	Intended to Measure
1	Fertilizer consumption (+ ve)	Use of modern inputs
2	Irrigation intensity (+ ve)	Efficiency of using water resource
3	Cropping intensity (+ ve)	Efficiency of using land resource
4	Area under non-foodgrains (+ ve)	Diversification towards growing more remunerative crops
5	Average size of holding (+ ve)	Size of production units (scale)
6	Productivity of total foodgrains (+ ve)	Production efficiency of foodgrains
7	Agricultural diversification: Herfindahl Index (+ ve)	Farming pattern (diversified vs. specialized)
8	Workers engaged in agriculture (+ ve)	Employment contribution
9	Net irrigated area as percentage of net sown area (+ ve)	Irrigation extent
10	Net area sown per cultivator (+ ve)	Availability of land
11	Number of commercial banks per 1000 cultivators (+ ve)	Availability of financial institutions
12	Number of agricultural credit cooperatives per 1000 cultivators (+ ve)	Presence of agricultural credit cooperatives
13	Area under high yielding varieties (+ ve)	Use of modern inputs
14	Magnitude of culturable waste land (- ve)	Inefficiency in land use
15	Magnitude of other fallow land (- ve)	Inefficiency in land use

Note: (+ve) and (-ve) indicate the type of an indicator as positive or negative, in that order.

3.4.2. Tools of Analysis

Here the statistical tools used in the analysis of data are given in detail so as to clarify the way results are established and to increase the reliability of the study.

i. Method of Moving Averages (MA)

The method of moving averages is mainly used for determining trend of a time series data but it can also be used to remove cyclical, seasonal and irregular variations from a time-series. The purpose of averaging is to give a smoother curve and to reduce the influence of fluctuations that pull the annual figures away from the general trend due to one or the other reasons. When a trend is to be determined by the method of moving averages, the average value for a number of years (or months, or quarters or weeks) is secured and this average is taken as the normal or trend value for the point of time falling at middle of the period covered in the calculation of the average. In applying this method, it is necessary to select a period for moving average such as 3-yearly moving average, 5-yearly moving average, 8-yearly moving average, etc. The first indicated the average of three years, the second average of 5 years and the last one denotes the average of 8 years in a time-series. The period of moving average is to be considered in the light of the length of the cycle of cyclical variations which it intends to remove. It is necessary to select a period which coincides with the length of the cycle otherwise the cycle will not be completely removed. However, the length of the cycle is not the same over the period rather it varies so it is difficult to select a single period that removes all the variations. Generally, the necessary period may range between three and ten years or even larger periods are required for certain types of data. Researchers often use the term triennium endings to describe a three yearly moving average and this is the average value attributed to the last year in a three year period for which the average is calculated. In the present study, 3-yearly moving average is used in the same context. A three yearly moving average (MA) is computed as follows:

$$Three\ Yearly\ MA = \frac{a+b+c}{3}, \frac{b+c+d}{3}, \frac{c+d+e}{3}, \frac{d+e+f}{3}, \ldots$$

where, MA stands for moving average, and the letters a, b, c, d, e, f denote figures corresponding to years in a time-series.

ii. Estimation of Compound Annual Growth Rates (CAGR)

Compound annual growth rates are widely employed in the field of agricultural economics as they have important policy implications. The usual parametric approach for growth rate analysis is to assume multiplicative error in the underlying nonlinear geometric model and then fit the linearized model by the method of ordinary least squares (OLS). The least square growth rates (r) were estimated by fitting a linear regression trend line to the logarithmic annual values of the variable in the relevant period. In other words, given the time-series data, compound growth rates were computed by fitting an exponential function to the available data, after making it linear through logarithmic transformation. An exponential trend function is defined as follows:

$$Y_t = Y_0 (1 + g)^t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where,

Y_t = dependent variable (area, production, yield, fertilizer consumption, etc.)

Y_0 = Constant term

g = regression coefficient (the rate at which Y grows each year)

t = time variable in years

For simplicity, the above equation can be written as under:

$$Y = ab^t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where, Y, a, b, and t means the same as Y_t, Y_0, (1+g) and t in the equation 1, respectively. To make the above exponential equation linear, logarithmic transformation is applied and new form of the above equation is given below:

$$\log Y = \log a + t \log b \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Equation 3 is now a semi-log linear function where values of the parameters a, and b can easily be estimated by using Ordinary Least Squares (OLS) method. Then the compound annual growth rates are computed by using the following formula:

$$CAGR\ (per\ cent\ per\ annum) = (b - 1) \times 100 \quad \ldots\ (4)$$

In equation 4, b {b = antilog (log b)} is the least square regression coefficient. Student's t-test was used for testing the significance of the values of the compound annual growth rates computed for the parameters of the study. '*Calculated t*' for the compound annual growth rates is obtained by applying the following formula:

$$t_{cal} = \frac{CAGR\ (r)}{SE\ (CAGR)}$$

Standard error of growth rate (r) was computed from the following formula:

$$SE\ (r) = \frac{100 \times b}{0.43429} \sqrt{\frac{(\sum \log y^2 - \log b \sum x \log y)}{(N-2)\sum x^2}}$$

where, y and x represent deviations taken from means and N denotes the number of observations.

For the test of significance of compound annual growth rates, a *two tail t-test* was used. '*Calculated t*' values were computed using the above mentioned formula and these values of '*calculated t*' (t_{cal}) were then compared with the values of '*tabulated t*' (t_{tab}) at the given degrees of freedom and accepted level of probability (1% and 5%) to determine the significance of the values of compound annual growth rates. Decision of significance or non-significance of the values of compound annual growth rate was taken on the following basis:

⇒ If $t_{cal} > t_{tab}$ the growth rate was considered as significant at the given level of probability and degrees of freedom.

⇒ If $t_{cal} < t_{tab}$ the growth rate was treated as non-significant at the given level of probability and degrees of freedom.

iii. Herfindahl Index (HI)

The Herfindahl index (HI) has been frequently used as a measure of agricultural diversification by the researchers. In effect, Herfindahl index is a measure of concentration describing how many crops are being grown by the farmers in a particular region, that is, whether farmers grow many or few crops. Hence, this index considers growing many crops as diversification and growing

a few crops as specialization. Herfindahl index is defined as the sum of squares of acreage proportion of each crop in the total cropped area.

The index has been computed using the following formula:

$$Herfindahl\ Index\ (H.I.) = \sum_{i=1}^{N} P_i^2$$

where

N = is the total number of crops

P_i = the proportion of area under i^{th} crop which can be worked out by using the following formula:

$$P_i = \frac{A_i}{\sum_{i=1}^{N} Ai}$$

where, A_i stands for the actual area under i^{th} crop.

Herfindalh index takes a value one when there is complete specialization and approaches zero when N gets larger, that is, if there is perfect diversification. Thus, the Herfindahl index is bounded by zero and one which are the two extremes but in reality it will take some value between these two extremes (0<H.I<1). As this index (HI) is a measure of concentration or diversification in its traditional sense i.e. growing many crops together and as such cannot explain the modern definition of agricultural diversification in terms of increase in area under high value crops. Hence, the area under non-foodgrains was taken as an alternative measure of diversification in the modern sense. That is, a move away from growing less lucrative crops towards growing more remunerative crops.

iv. Splicing

The problem of combining two or more overlapping or discontinued series of index numbers or actual data into one continuous series is called splicing. The need for splicing arises to secure continuity in comparison. It happens quite often that an index or a data series is discontinued because its base has become too old, and a new index or series may be started with the

same items and some recent years as base. If it is desired to connect the new index numbers or data series with that of old discontinued one, the old index numbers or data series would be spliced to the new index numbers or data series, the resultant index numbers or data series would enable comparison among the two series on the basis of a single base, that is, the base of the recent data series. The process of splicing is very simple and is akin to that used in shifting the base. In the present study, the state level data on gross state domestic product (GSDP) at factor cost and at constant price were available in four discontinued data series and the need was felt to bring them into a single series with a common base. The first series belonged to a period from 1980-81 to 1995-96 with 1980-81 prices as base. The second series covered a period from 1993-94 to 2005-06 with 1993-94 prices as base. The third series belonged to a period from 1999-00 to 2009-10 with 1999-00 prices as base. The fourth series was available for a period from 2004-05 to 2010-11 with 2004-05 prices as base. By applying splicing the three first series were spliced to the fourth series with a common base of 2004-05. It was done for both real gross state domestic product and gross state domestic product originating from agriculture *(see Appendix 3).* To splice the first data series to the second data series, a common year was selected for which data were available in both the series (a year of the old series corresponded to the initial year of the new series). In order to splice the first data series to the second data series, a common factor was worked out by dividing the second data series figure of Rs. 478268 *lakh* for the year 1993-94 by the first data series figure of Rs. 142028 *lakh* for the same year (1993-94) the result gave the value of common factor 3.36742. Then all figures of the first data series were multiplied by the common factor so that to bring them all under the second series with the base year of 1993-94 and ease the comparison. On the same line, for splicing second data series to third data series a common factor was worked out by dividing the third data series figure of Rs. 1411247 *lakh* for the year 1999-00 by the second data series figure of Rs. 724143 *lakh* for the same year (1999-00) and the result gave the value of common factor 1.94885. Then all figures of the second series were multiplied by the common factor so as to bring them all under the third data series with a base year of 1999-00. Similarly, the third data series was spliced to the fourth data series by dividing the fourth data series figure of Rs. 2407658

lakh for the year 2004-05 by the third data series figure of Rs. 1928118 *lakh* for the same year (2004-05) and the result provided the value of common factor 1.24871. Then all figures of the third series were multiplied by the common factor so that to bring them all under fourth data series with 2004-05 as the base. Table 3.2 provides the details of splicing of data series for gross state domestic product at factor cost and constant prices.

Table 3.2 Splicing Procedure of Data Series for Gross State Domestic Product of Himachal Pradesh at Constant Prices to a Common Base, 2004-05.

Years	Series 1 1980-81=100	Series 2 1993-94=100	Series 1 spliced to series 2 with 1993-94 as base (series 1 × CF)
1980-81	79404		79404 × 3.36742 = 267387
1981-82	84146		84146 × 3.36742 = 283355
1982-83	81827		81827 × 3.36742 = 275546
-			-
-			-
-			-
1993-94	**142028**	**478268**	**CF = 478268 ÷ 142028 = 3.36742**
1994-95		524393	
1995-96		556846	
1996-97		595528	
1997-98		633514	
1998-99		679197	
1999-00		724143	

Contd...

Years	Series 2 1993-94 = 100	Series 3 1999-00 = 100	Series 2 spliced to series 3 with 1999-00 as base (series 2 × CF)
1980-81	267387		267387 × 1.94885 = 521096
1981-82	283355		283355 × 1.94885 = 552216
1982-83	275546		275546 × 1.94885 = 536998
-	-		-
-	-		-
-	-		-
1999-00	**724143**	**1411247**	**CF = 1411247 ÷ 724143 = 1.94885**
2000-01		1500421	
2001-02		1578609	
2002-03		1658469	
2003-04		1792500	
2004-05		1928118	

Contd...

Years	Series 3 1999-00 = 100	Series 4 2004-05 = 100	Series 3 spliced to series 4 with 2004-05 as base (series 3 × CF)
1980-81	521096		521096 × 1.24871 = 650698
1981-82	552216		552216 × 1.24871 = 689558
1982-83	536998		536998 × 1.24871 = 670554
-	-		-
-	-		-
-	-		-
2004-05	**1928118**	**2407658**	**CF = 2407658 ÷ 1928118 = 1.24871**
2005-06		2610733	
2006-07		2848060	
2007-08		3091672	
2008-09		3319192	
2009-10		3588814	
2010-11		3911186	

The same procedure was applied for splicing of data series of gross state domestic product originating in agriculture at constant prices. The formula for calculating the common factor is given bellow:

$$Common\ Factor^{1}\ (CF) = \frac{New\ series\ initial\ year\ figure}{Old\ series\ last\ year\ figure}$$

v. Ranking Method

One of the methods used in the present study in determining the levels of agricultural development across the districts was ranking method. This method which comprises the assigning of rank scores to individual indicators and aggregating them at the desired level is the simplest and most commonly used method in regional analysis. In India, Ashok Mitra (1964) had used it initially with respect to census data of 1961. Subsequently, many studies including Dandekar Committee (1984) adopted this method. Prabhu and Sarker (1992) had used this method to identify the levels of agricultural development of districts in Maharashtra. In the present study, this method was used to determine the levels of agricultural development of the districts of Himachal Pradesh at two points of time i.e. 1991-92 and 2004-05. It is mentionable that the ranking method was mainly used for positive indicators only. Since, in the present study both positive

[1] The last year of old series and first year of new series are the same years.

and negative indicators were considered the need arose to modify the method for assigning the rank scores to the negative indicators *(see Appendix 8)*. Hence, the rank scores were assigned by ranking the district in ascending order of ranking for each of the first 13 positive indicators and in descending order for each of the last two negative indicators. The positive indicators were ranked in ascending order so that district with smaller value of an indicator gets lower rank score and district with larger value of an indicator secures higher rank score. On the contrary, the negative indicators were ranked in descending order so as the district with smaller value of an indicator gets higher rank score and the district with larger value of an indicator secures lower rank score. The rank scores for the individual indicators were then summed up for all the districts to arrive at the aggregate scores. Finally, districts were ranked in descending order for the aggregated scores so that the district with the highest aggregate rank score secures the first rank which means the best performance and the rest in that order.

vi. Indexing Method

The indexing was another method used in the present study for the purpose of identifying the levels of agricultural development of the districts in Himachal Pradesh. The indexing method wherein the indicators for each region are expressed as percentage or proportion of the state or national average is considered to be an improvement over the ranking method. Among others, this method was used by the Chakravarty Committee (1980), Dholakia (1985) and Prabhu and Sarker (1992). In this method, first the average value for each of the 15 indicators chosen for indentifying the levels of agricultural development of the districts in the state was obtained. Then the index scores were obtained by expressing the value of each indicator as percentage of its corresponding state average for all the districts. Since indexing method treats both positive and negative indicators the same way, therefore, the need was felt to modify the indexing method in such away to treat both of these indicators differently *(see Appendix 9)*. That is, the districts having higher value of positive indicators should get higher index scores and *vice versa*. On the contrary, the districts with lower value of a negative indicator should secure higher index scores and *vice versa*. Thus, the indexing method was modified for the negative indicators. The modification was simply done by changing the sign of state's average value of

the negative indicators from positive to negative, in order to make the index scores negative for all the districts. By doing so, the smaller index scores will get higher weights as compared to the larger index scores. It means in negative values the one closer to zero is considered the largest. This way, the index was modified for negative indicators so that the districts with smaller value of a negative indicator secure higher index scores and the districts with large value of a negative indicator get smaller index scores for in case of negative indicators small value implies best performance and *vice versa*. The index scores of all the indicators were then summed up for all the districts so as to arrive at the aggregate index scores. Finally, districts were ranked in descending order for the aggregated index scores so that the district with the highest aggregate index score gets the first rank which means the best performance and the rest of districts secure ranks as regard to their total index scores in that order.

vii. Agricultural Development Index (ADI) Method

The agricultural development index (ADI) is a composite index assembled of several indicators that are in turn derived from a number of other variables or datasets, which cover a wide range of issues such as population, land use pattern, natural resources, infrastructure, impacts on health and governance. Equal weights are given to all of the indicators. Like other popular composite indices of development, such as the Human Development Index (HDI), the ADI is comprehensive in capturing multi-dimensions of areas related to agricultural development. The ADI is in accordance with other well-tested and accepted statistical methods of international standard and follow the statistical steps prescribed by the Handbook of Organization for Economic Co-operation and Development (OECD, 2005) titled "Handbook on Constructing Composite Indicators". The ADI aimed at capturing district level agricultural development. Hence, its success depends upon easy availability of reliable data at district level. This index attempts to capture the inter-play of various variables of agricultural development in showing the comparative level of development of a region. The variables also reflect results and social distribution of such results. However, the ADI was used in the present study to capture the levels of agricultural development of the districts of Himachal

Pradesh at two points of time, 1991-92 and 2004-05. A set of 15 indicators was selected (*see Table 3.1*) based on the availability of data, and relevance to the context of the state, which covered the main areas of agricultural development suggested by the ADI. Normalization was done so that to bring the indicators to a common scale and to make them less vulnerable to inconsistencies and anomalies. The well-accepted method of max-min (range equalization) was used for the purpose which converted all the indicators in the range of 0 and 1. Different formulae were used for normalizing positive and negative indicators. For normalizing values of the positive indicators the following formula was used:

$$Achievement\ Level = \frac{Actual\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}$$

To normalize values of the negative indicators the following formula was adopted:

$$Achievment\ Level = \frac{Maximum\ Value - Actual\ Value}{Maximum\ Value - Minimum\ Value}$$

The aggregation was done to combine the values of the components of the composite index (ADI scores for the indicators). It involves linear or arithmetic averaging of the ADI scores of all the indicators for the 12 districts. Eventually, the districts were ranked in descending order from the first rank denoting the best performance to the twelfth rank implying the worst performance in terms of agricultural development.

viii. Coefficient of Variation (CV)

Standard deviation is an absolute measure of dispersion. The corresponding relative measure is known as coefficient of variation. This measure developed by *Karl Pearson* is the most commonly used measure of relative variation. It is used in such problems where the variability of two or more than two series is to be compared. The series (or group) for which the coefficient of variation is greater is said to be more variable or less consistent, less uniform, less stable or less homogeneous. On the other hand, the series for which the coefficient of variation is less is said to be less variable, or more consistent, more uniform,

more stable or more homogeneous. Coefficient of variation is denoted by C.V. and is obtained as follows:

$$Coefficient\ of\ Variation\ (\%) = \frac{\sigma}{\bar{X}} \times 100$$

Coefficient of variation is, thus, standard deviation expressed as percentage of mean. In the above formula σ stands for standard deviation and $\bar{X}$ denotes arithmetic mean. Their formulae are given in equation 1 and 2, in that order.

$$Standard\ Deviation\ (\sigma) = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(X_i - \bar{X})^2} \quad \ldots\ldots \quad (1)$$

$$Arithmetic\ Mean\ (\bar{X}) = \frac{1}{N}\sum_{i=1}^{N} X_i \quad \ldots\ldots\ldots \quad (2)$$

where, X_i denotes values of the individual observation and N is the total number of observations.

In the present study coefficient of variation was used to capture the disparities among the districts of Himachal Pradesh in terms of agricultural development based on the 15 selected indicators of agricultural development (*see Table 3.1*).

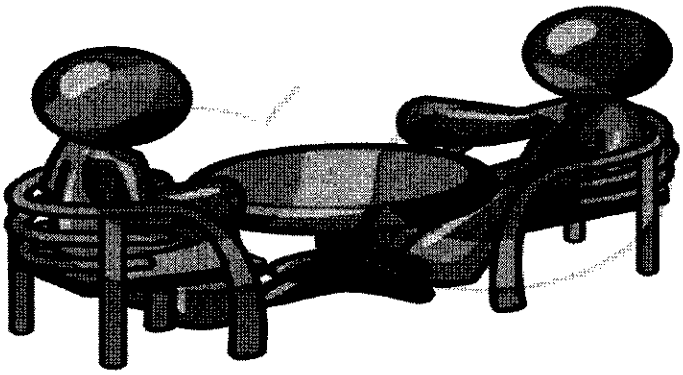
3.5. Limitations of the Study

Throughout the study due attention was devoted to maintain its reliability. Data collection, entry, analysis and tabulation were accomplished with full care and attention. Cross checking of the data was done and the discrepancies were, thus, corrected. Triennium endings were calculated so as to smoothen the trends and reduce seasonal and cyclical variations of the time-series data, but still there were some abnormal figures which could not be explained. However, there were cases when a single figure in data-series was missing and calculation of growth rates was restrained, hence the gap was filled by taking average of the two surrounding figures instead of performing formal interpolation, so that growth rates could be calculated. Crop and crop groups given in the data books were re-arranged in studying the cropping pattern, production and yield so as to better serve the

objectives of the study. Pea which is classified as pulse in the 'annual season and crop report' was categorized as vegetable in the present study because the pea in the state of Himachal Pradesh is mainly grown as a green vegetable. Thus, the area under pea was deducted from pulses acreage and added to area under total vegetables. Some of the indicators such as mechanization, real gross state domestic product and area under high yielding verities were not studied at districts level because of the unavailability of the required data. Although, livestock sector is an integral part of agriculture, due to time, labour and financial hindrances the study was confined mainly to the crop production aspect of agriculture. However, it was considered in studying product contribution of agriculture to the economy. Various methods of analyzing the indicators were available and each had its advantages and disadvantages; the most appropriate among them were purposively selected and used in the present investigation.

Chapter 4

Results And Discussion



An inclusive discussion of the research findings produces valuable information.

4. RESULTS AND DISCUSSION

Results and discussion is the main part of any research project. It is in fact the processing of numerical data into information with a purpose to accomplish the stated research objectives. A systematic and scientific discussion on the results of a study can answer the research question and highlight the areas of success and failure, as well as, the problems and their possible solutions. Therefore, this chapter is devoted to discuss in detail the results obtained from the statistical analysis of the numerical data. To facilitate understanding and ensure systematic presentation of the topics, this section is discussed under the following headings:

4.1. Land Use Pattern

4.1.1. Trends in Area under Different Forms of Land Uses

4.1.2. Compound Annual Growth Rates of Area under Various Land Uses

4.2. Land Holding

4.3. Cropping Pattern

4.3.1. Trends in Cropping Pattern

4.3.2. Trends in Production, Area and Yield

4.3.3. Compound Annual Growth Rates of Production, Area and Yield

4.3.4. Cropping Intensity

4.3.5. Agricultural Diversification

4.4. Irrigation Status

4.4.1. Irrigation Extent

4.4.2. Irrigation Intensity

4.5. Input Use in Hill Agriculture

4.5.1. Trends in Fertilizer Consumption

4.5.2. Trends in Area under High Yielding Varieties

4.5.3. Extent of Mechanization

4.6. Employment in Agriculture

4.6.1. Trends in Agricultural Employment

4.6.2. Agricultural Work Participation Rate

4.7. Contribution of Agriculture to the State Economy

4.8. Agricultural Development

4.8.1. Levels of Agricultural Development across Districts

4.8.2. Inter-District Disparities in Agricultural Development

4.1. Land Use Pattern

Land is, indisputably, one of the critical factors of production not only for agriculture but also for manufacturing and services as no economic activity can take place in the absence of land. It is one of scarce productive resources which can be put to various alternative uses. Being a fixed resource, it cannot be increased in magnitude and its supply is inelastic. Hence, land use pattern which measures the land use changes among different sectors of the economy became a crucial concept. It is a dynamic concept for land use pattern changes overtime subject to various economic and non-economic factors. Policy makers and planners have to maintain a balance between agricultural and non-agricultural uses of land and ensure sustainable utilization of land resources. However, in the hilly regions with a rugged terrain like Himachal Pradesh, the area under plough is always a cause of serious concern, as it is impossible to bring more area under cultivation due to colossal costs involved. It is further subject to population pressures, urbanization and industrialization processes (Kumar 2011). Nearly 90 per cent of the state's population lives in rural areas and mostly depends on land as a source of livelihood. Thus, in the present study an attempt has been made to analyze the land use changes that have occurred during the past four decades or so, at the state as well as district levels.

4.1.1. Trends in Area under Different Forms of Land Uses

Land use underwent many changes both at the state and district levels during the study period, 1972-73 to 2007-08 (Table 4.1.1). This table unfolds district-wise changes in land use pattern in the state at three points of time, namely, triennium endings 1974-75, 1990-91 and 2007-08. According to '*Village Papers*[2] reporting area of the state increased by 1559.53 thousand hectares from 2933.60 thousand hectares in 1974-75 to 4493.13 thousand hectares in 2007-08. Net sown area as percentage of reporting area declined, by almost 7 per cent points from 18.85 per cent in 1974-75 to 11.79 per cent of that in 2007-08. Here it is important to note that in absolute terms net sown area in the state increased by about 30 thousand hectares between 1974-75 and 1990-91. However, there was a massive decline of about 53 thousand hectares between 1990-91 and 2007-08. Current fallows depicted a marginal decrease from 1.82 per cent to 1.32 per cent whereas other fallows increased slightly from 0.12 per cent to 0.34 per cent during the study period with a decline in the latter between 1990-91 and 2007-08. Culturable waste underwent a decline

[2] Reporting area for which the revenue papers exist.

from 4.41 per cent in 1974-75 to 2.84 per cent in 2007-08. However, from the perspective of area amenable to cultivation in absolute terms, while current fallows witnessed an increase of 6000 hectares during the overall period, the increase being very high (15500 hectares) between 1990-91 and 2007-08. As regards the other fallows while there was huge increase of about 16000 hectares between 1974-75 and 1990-91, it declined by about 4000 hectares during the latter period. Culturable waste also depicted a decline of about 2000 hectares during the overall study period. Furthermore, area covered by forests as per cent of reporting area grew up from 21.75 per cent to 24.36 per cent; however, a downturn was evident after 1990-91. Barren land went up from 4.44 per cent to 14.53 per cent, but permanent pastures experienced a reduction from 40.47 per cent to 33 per cent. Area put to non-agricultural uses increased from 6.67 per cent in 1974-75 to 10.36 per cent in 2007-08. Similarly, in absolute terms it grew up by 2.38 times from 195.60 thousand hectares in 1974-75 to 465.57 thousand hectares in 2007-08. Of late, such factors as the wild animal menace (monkeys, blue bulls, stray animals, wild boars, etc.) have been fuelling the process of rendering culturable land unfit for use and the farmers are being compelled to abandon their main livelihood option of farming in many areas. As far as land under non-agricultural uses is concerned, most of it has been coming from the cultivated area only. Such diversion of good quality fields to non-agricultural uses, on and near the road heads and small markets is a common feature anywhere in the state. Most probably these changes may not have been incorporated in the revenue records. This will have implications not only for the sustainability of ongoing diversification but also for food security of the state (Kumar 2011).

As regards the reporting area at the district level, it increased substantially in the tribal districts of Lahaul & Spiti (842.3 thousand hectares) and Kinnaur (598.5 thousand hectares) during 1974-75 to 2007-08. Net sown area as a percentage of reporting area came down in most of the districts (nine) but the decline was conspicuous in Kinnaur (63 per cent points) and Shimla (10 per cent points) during the same period. However, it grew up in Bilaspur, Chamba and Kullu. Net sown area also decreased in absolute terms in most of the districts (eight) but the decline was substantial in Kinnaur (8.78 thousand hectares), Solan (5.13 thousand hectares) and Una (4.74 thousand hectares) whereas it increased in absolute terms in Kullu and Lahaul & Spiti with the highest increase observed in Kullu (12 thousand hectares) during the study period. The decrease in net sown area in Solan and Una could be attributed to the population pressure in these otherwise small sized districts

whereas in Kinnaur it might be attributed to the re-classification of the area under various land use categories. However, in Mandi and Shimla districts net sown area remained almost stagnant between 1972-73 and 2007-08.

As percentage of reporting area, other fallows grew up at varying rates in most of the districts (nine) while a decline was observed in Kanga, Kinnaur and Lahaul & Spiti during 1974-75 and 2007-08. In absolute terms, other fallows increased substantially in Shimla (3.4 thousand hectares), Sirmaur (2.79 thousand hectares) and Una (1.91 thousand hectares) while the decrease was very pronounced in Kangra (4.23 thousand hectares) during the same period. Similarly, per cent share of current fallows in reporting area increased at varying magnitudes in Bilaspur, Chamba, Mandi, Shimla, Sirmaur and Solan but it declined in rest of the districts with Kinnaur witnessing the highest decline of 6.69 per cent points overtime from 1974-75 to 2007-08. In absolute terms, while current fallows increased substantially in Mandi (7.88 thousand hectares) and Shimla (6.32 thousand hectares), it decreased remarkably in Kangra (8.41 thousand hectares) and Hamirpur (2.77 thousand hectares) over the same period.

As regards the per cent share of culturable waste in reporting area, it went up in majority of the districts (eight) with the highest increase observed in Una (8.23 per cent points) whereas it declined in rest of the districts with considerable decline witnessed in Kinnaur (6.69 per cent points) and Kangra (6.40 per cent points) during 1974-75 to 2007-08. In absolute terms, the increase in culturable waste was observed to be the highest in Una (12.79 thousand hectares) but the decline was found to be substantial in Kangra (28.71 thousand hectares) during the same period. Moreover, as percentage of reporting area, land put to uses other than agriculture i.e. non-agricultural uses, grew up in Kinnaur, Lahaul & Spiti, Shimla, Mandi, Kangra, Hamirpur and Sirmaur with the highest increase witnessed in the tribal districts of Lahaul & Spiti (13.49 per cent points) and Kinnaur (9.65 per cent points) overtime from 1974-75 to 2007-08. The increase in area under non-agricultural uses in absolute terms was very pronounced in Lahaul & Spiti (134.75 thousand hectares), Kinnaur (119.88 thousand hectares), Kangra (16.03 thousand hectares), Mandi (7.62 thousand hectares) and Shimla (7.11 thousand hectares) during the same time period. This implies input diversion (land) from agricultural production to non-agricultural one which in turn has its effects on agricultural economy of the state. While the increase in area put to non-agricultural uses in the tribal districts of Lahaul & Spiti and Kinnaur might be

attributed to the development projects, especially hydro electric projects, it could be ascribed to the increasing population pressure in the remaining districts additionally.

In a nutshell, the analysis of temporal changes in land use over the period from 1974-75 to 2007-08 revealed that Kangra, Kinnaur, Kullu, Lahaul & Spiti and Shimla experienced an increase in reporting area which was more conspicuous for the tribal districts of Kinnaur and Lahaul & Spiti especially from 1990s onwards. Further, share of net area sown in reporting area grew up in Bilaspur, Chamba, Kullu, and Mandi whereas it declined for rest of the districts. Apart from Bilaspur, Chamba, Mandi, Shimla and Solan, the share of current fallows declined. Other fallows decreased in Kangra, Kinnaur and Lahaul & Spiti whereas it increased in rest of the districts. Besides, Kangra, Kinnaur, Lahaul & Spiti, and Shimla were among the districts whose share of culturable waste declined while that in rest of the districts experienced an increase. These three categories of land use which are amenable to cultivation have useful implications in the sense that they affect productive potential and livelihood in the fragile hill agriculture. The increase in area put to uses other than agriculture was quite high in the tribal districts of Lahaul & Spiti and Kinnaur.

Table 4.1.1 Trends in District-wise Land Use Pattern in Himachal Pradesh, 1972-73 to 2007-08. ('000 ha)

Triennium Ending (TE)	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Himachal Pradesh									
1974-75	2933.60 (100.00)	638.03 (21.75)	130.23 (4.44)	195.60 (6.67)	129.50 (4.41)	1187.17 (40.47)	43.00 (1.47)	53.53 (1.82)	3.60 (0.12)	552.93 (18.85)
1990-91	3364.23 (100.00)	1001.43 (29.77)	184.07 (5.47)	198.67 (5.91)	126.13 (3.75)	1162.27 (34.55)	45.73 (1.36)	44.00 (1.31)	19.27 (0.57)	582.80 (17.32)
2007-08	4493.13 (100.00)	1094.53 (24.36)	652.93 (14.53)	465.57 (10.36)	127.57 (2.84)	1482.73 (33.00)	65.40 (1.46)	59.50 (1.32)	15.33 (0.34)	529.73 (11.79)
	Bilaspur									
1974-75	115.47 (100.00)	11.87 (10.28)	3.87 (3.35)	16.97 (14.69)	3.00 (2.60)	46.67 (40.42)	0.04 (0.04)	1.37 (1.18)	0.43 (0.38)	31.20 (27.02)
1990-91	115.47 (100.00)	11.37 (9.84)	7.30 (6.32)	14.03 (12.15)	4.83 (4.19)	42.83 (37.10)	0.10 (0.09)	1.93 (1.67)	1.03 (0.89)	32.13 (27.83)
2007-08	111.79 (100.00)	14.00 (12.53)	4.40 (3.93)	14.91 (13.34)	6.16 (5.51)	39.00 (34.88)	0.11 (0.10)	1.66 (1.49)	1.14 (1.02)	30.41 (27.20)
	Chamba									
1974-75	826.10 (100.00)	103.77 (12.56)	2.33 (0.28)	14.53 (1.76)	5.73 (0.69)	657.30 (79.57)	0.01 (0.002)	2.13 (0.26)	0.27 (0.03)	40.00 (4.84)
1990-91	692.40 (100.00)	271.60 (39.23)	4.67 (0.67)	11.93 (1.72)	5.60 (0.81)	354.70 (51.23)	0.27 0.04)	2.10 (0.30)	0.30 (0.04)	41.33 (5.97)
2007-08	692.41 (100.00)	272.00 (39.28)	5.41 (0.78)	12.08 (1.74)	6.28 (0.91)	352.12 (50.85)	0.01 (0.001)	2.03 (0.29)	0.54 (0.08)	38.07 (5.50)

Contd... ('000 ha)

Triennium Ending (TE)	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Hamirpur									
1974-75	111.17 (100.00)	19.50 (17.54)	20.60 (18.53)	12.57 (11.30)	8.50 (7.65)	2.30 (2.07)	-	8.43 (7.59)	-	39.27 (35.32)
1990-91	109.97 (100.00)	20.03 (18.22)	14.33 (13.03)	17.00 (15.46)	10.83 (9.85)	0.40 (0.36)	-	8.20 (7.46)	0.33 (0.30)	38.93 (35.40)
2007-08	110.21 (100.00)	18.29 (16.60)	15.19 (13.79)	17.29 (15.69)	11.26 (10.22)	5.70 (5.18)	-	5.66 (5.14)	1.64 (1.49)	35.19 (31.93)
	Kangra									
1974-75	504.70 (100.00)	201.87 (40.00)	32.17 (6.37)	61.70 (12.23)	57.03 (11.30)	15.40 (3.05)	-	19.03 (3.77)	-	117.53 (23.29)
1990-91	577.50 (100.00)	233.00 (40.35)	42.07 (7.28)	79.30 (13.73)	49.63 (8.59)	38.67 (6.70)	3.23 (0.56)	5.70 (0.99)	5.35 (0.93)	122.37 (21.19)
2007-08	577.79 (100.00)	231.96 (40.15)	15.31 (2.65)	77.82 (13.47)	28.32 (4.90)	87.93 (15.22)	8.33 (1.44)	10.62 (1.84)	1.12 (0.19)	116.32 (20.13)
	Kinnaur									
1974-75	25.77 (100.00)	0.003 (0.01)	1.80 (6.99)	2.57 (9.96)	1.87 (7.24)	1.00 (3.88)	0.20 (0.78)	1.80 (6.99)	0.07 (0.26)	16.47 (63.91)
1990-91	223.40 (100.00)	21.30 (9.53)	34.13 (15.28)	2.83 (1.27)	1.83 (0.82)	153.67 (68.79)	0.10 (0.04)	1.63 (0.73)	0.73 (0.33)	7.60 (3.40)
2007-08	624.27 (100.00)	37.58 (6.02)	131.85 (21.12)	122.45 (19.61)	3.46 (0.55)	319.13 (51.12)	0.11 (0.02)	1.88 (0.30)	0.10 (0.02)	7.69 (1.23)

Contd... ('000 ha)

Triennium Ending (TE)	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Kullu									
1974-75	36.33 (100.00)	-	1.90 (5.23)	4.70 (12.94)	1.63 (4.50)	0.53 (1.47)	0.40 (1.10)	2.50 (6.88)	0.03 (0.09)	24.67 (67.89)
1990-91	50.13 (100.00)	-	4.13 (8.24)	3.87 (7.71)	2.73 (5.45)	0.39 (0.78)	0.30 (0.60)	2.33 (4.65)	0.18 (0.35)	32.00 (63.83)
2007-08	51.65 (100.00)	-	1.12 (2.17)	6.26 (12.13)	2.74 (5.30)	[3]0.10 (0.20)	0.88 (1.70)	3.33 (6.45)	[4]0.20 (0.40)	36.58 (70.82)
	Lahaul & Spiti									
1974-75	68.90 (100.00)	4.13 (6.00)	0.33 (0.48)	0.97 (1.40)	0.13 (0.19)	60.57 (87.91)	0.10 (0.15)	0.17 (0.24)	-	2.50 (3.63)
1990-91	215.60 (100.00)	77.67 (36.02)	4.53 (2.10)	1.60 (0.74)	0.57 (0.26)	127.80 (59.28)	0.10 (0.05)	0.08 (0.04)	0.10 (0.05)	3.13 (1.45)
2007-08	911.20 (100.00)	135.39 (14.86)	415.68 (45.62)	135.72 (14.89)	0.60 (0.07)	220.10 (24.15)	0.11 (0.01)	[5]0.10 (0.01)	[6]0.06 (0.01)	3.29 (0.36)
	Mandi									
1974-75	397.47 (100.00)	148.13 (37.27)	14.93 (3.76)	7.63 (1.92)	4.23 (1.07)	134.30 (33.79)	0.10 (0.03)	2.03 (0.51)	0.13 (0.03)	85.97 (21.63)
1990-91	397.07 (100.00)	165.27 (41.62)	11.30 (2.85)	12.33 (3.11)	4.10 (1.03)	105.67 (26.61)	0.20 (0.05)	2.60 (0.65)	0.27 (0.07)	95.30 (24.00)
2007-08	397.81 (100.00)	175.21 (44.04)	9.76 (2.45)	15.25 (3.83)	4.47 (1.12)	96.25 (24.20)	0.38 (0.10)	9.91 (2.49)	0.15 (0.04)	86.30 (21.70)

[3] It corresponds to the TE 1998-99.
[4] It corresponds to the TE 2002-03.
[5] It corresponds to the TE 2006-07.
[6] It corresponds to the TE 2003-04.

Contd... ('000 ha)

Triennium Ending (TE)	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Shimla									
1974-75	285.37 (100.00)	48.43 (16.97)	10.63 (3.73)	8.77 (3.07)	12.53 (4.39)	128.23 (44.94)	2.10 (0.74)	6.27 (2.20)	1.03 (0.36)	67.43 (23.63)
1990-91	423.33 (100.00)	104.17 (24.61)	15.30 (3.61)	15.73 (3.72)	10.37 (2.45)	189.87 (44.85)	3.60 (0.85)	7.13 (1.69)	1.50 (0.35)	75.70 (17.88)
2007-08	508.73 (100.00)	129.64 (25.48)	14.46 (2.84)	15.88 (3.12)	16.14 (3.17)	237.02 (46.59)	10.91 (2.14)	12.59 (2.47)	4.43 (0.87)	67.70 (13.31)
	Sirmaur									
1974-75	224.80 (100.00)	48.30 (21.49)	7.00 (3.11)	9.10 (4.05)	14.17 (6.30)	63.93 (28.44)	36.27 (16.13)	2.73 (1.22)	0.47 (0.21)	42.90 (19.08)
1990-91	224.77 (100.00)	48.67 (21.65)	7.67 (3.41)	9.27 (4.12)	13.20 (5.87)	61.53 (27.38)	36.33 (16.16)	4.00 (1.78)	1.00 (0.44)	43.27 (19.25)
2007-08	224.75 (100.00)	48.30 (21.49)	8.51 (3.79)	10.49 (4.67)	14.71 (6.55)	56.98 (25.35)	37.30 (16.60)	4.57 (2.03)	3.26 (1.45)	40.59 (18.06)
	Solan									
1974-75	183.30 (100.00)	20.27 (11.06)	6.30 (3.44)	25.30 (13.80)	10.27 (5.60)	70.57 (38.50)	3.83 (2.09)	3.07 (1.67)	0.63 (0.35)	43.10 (23.51)
1990-91	180.43 (100.00)	19.77 (10.96)	10.17 (5.63)	10.87 (6.02)	11.93 (6.61)	80.10 (44.39)	1.40 (0.78)	4.20 (2.33)	0.77 (0.42)	41.20 (22.83)
2007-08	180.91 (100.00)	20.30 (11.22)	12.40 (6.86)	12.07 (6.67)	14.78 (8.17)	77.29 (42.72)	0.45 (0.25)	4.68 (2.59)	0.86 (0.47)	37.97 (20.99)

Contd... ('000 ha)

Triennium Ending (TE)	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Una									
1974-75	154.20 (100.00)	31.73 (20.58)	28.37 (18.40)	30.87 (20.02)	10.40 (6.74)	6.40 (4.15)	-	3.97 (2.57)	0.50 (0.32)	41.90 (27.17)
1990-91	154.20 (100.00)	28.70 (18.61)	28.53 (18.50)	19.90 (12.91)	10.43 (6.77)	6.90 (4.47)	0.10 (0.06)	4.20 (2.72)	9.97 (6.46)	45.53 (29.53)
2007-08	154.91 (100.00)	18.18 (11.74)	22.21 (14.34)	28.81 (18.60)	23.19 (14.97)	12.60 (8.13)	7.02 (4.53)	3.73 (2.41)	2.41 (1.55)	37.16 (23.99)

Note: Figures in brackets are percentages to reporting area.

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, and Statistical Outline of Himachal Pradesh, 2009-10, Department of Economics and Statistics, Shimla-9, Government of Himachal Pradesh.

4.1.2. Compound Annual Growth Rates of Area under Various Land Uses

In the preceding section changes in land use pattern were discussed both in per cent terms and in absolute magnitudes. However, to have a clear picture of the trends in various land-use categories, compound annual growth rates for different types of land uses were calculated and are discussed under this heading. Table 4.1.2 portrays district-wise compound annual growth rates of land use categories in Himachal Pradesh during 1972-73 to 2007-08 (overall period) which is further divided into two sub- periods, viz., first period from 1972-73 to 1989-90 and second period from 1990-91 to 2007-08. It can be seen from the table that reporting area in the state registered a growth rate of 1.54 per cent per annum (% p.a.) which was higher in the second period (2.21% p.a.) than in the first period (0.93% p.a.). This implies that reporting area went up at a higher rate during 1990s and onwards. It is worth mentioning here that while scanning through data, it was found that there was large increase in reporting area in the tribal districts of Lahaul & Spiti and Kinnaur during the early 1990s due to which reporting area in the state went up considerably. In case of net sown area, it was found that it decreased with a growth rate of 0.14 per cent per annum over the entire period of study. Decomposing the overall period revealed that net sown area increased (0.37% p.a.) in the first period while declined (-0.55% p.a.) during the second period. Current fallows and other fallows registered growth rates of -1.26 per cent and 13.72 per cent per annum during the first period, respectively, while in the second period current fallows increased (1.44% p.a.) but other fallows declined (-2.44% p.a.). However, for the whole period of study the latter increased at a higher rate (4.72% p.a.) than the first one (0.61% p.a.). There was no significant increase or decrease in culturable waste during the first and second periods, but it registered a decline (-0.66% p.a.) in the overall period. A rapid increase (6.51% p.a.) in area put to non-agricultural uses was witnessed during the second period while it was not considerable during the first period; however, the overall period demonstrated an increase of 2.54 per cent per annum in area under non-agricultural uses in the state. Moreover, during the first period, forests expanded at a higher rate (2.93% p.a.) followed by barren (2.29% p.a.), whereas permanent pastures and miscellaneous tree crops registered no significant growth. Barren land had the highest growth in the second period (11.12% p.a.) followed by permanent pastures (1.92% p.a.) and forests (0.39% p.a.) while there was no conspicuous increase in miscellaneous tree crops. Over the entire period, barren land maintained its growth stance and recorded a

growth rate of 6.21 per cent per annum followed by forests (1.74% p.a.), miscellaneous tree crops (1.64% p.a.) and permanent pastures (0.96% p.a.) in the state.

Expectedly, trends in reporting area were not uniform across the districts during the study period 1972-73 to 2007-08. Kinnaur registered the highest growth rate (12.28% p.a.) followed by Lahaul & Spiti (9.30% p.a.), Shimla (2.12% p.a.), Kullu (0.73% p.a.) and Kangra (0.23% p.a.). Except Sirmaur which recorded a slight decline, there was no significant change in reporting area in rest of the districts. Similarly, during the first period Kinnaur topped the list registering a growth rate of 20.44 per cent per annum followed by Lahaul & Spiti (13.36% p.a.), Shimla (2.59%) and Kangra (0.85% p.a.) whereas in the second period Lahaul & Spiti excelled Kinnaur by recording a growth rate of 11.31 per cent per annum followed by Kinnaur (7.81% p.a.) and Shimla (1.36% p.a.). For the whole period net sown area increased at the rate of 0.93 per cent and 0.63 per cent per annum in Kullu and Lahaul & Spiti, respectively. But, Bilaspur, Hamirpur, Kinnaur, Sirmaur, Solan and Una recorded a decline in net sown area ranging from 0.16 per cent per annum in Bilaspur to 0.95 per cent per annum in Kinnaur. However, rest of the districts experienced no considerable change in their net sown area. During the first period, most of the districts recorded an increasing trend with annual growth rates ranging from 0.23 per cent in Chamba to 3.11 per cent in Kullu while Kinnaur and Hamirpur registered decrease in net sown area with annual growth rates of 3.11 per cent and 0.42 per cent, respectively. The second period traced the trend otherwise: in most of the districts net sown area came down with yearly growth rates ranging from 1.01 per cent in Una to 0.37 per cent in Sirmaur. Apart from Lahaul & Spiti where net sown area grew up at the rate of 0.33 per cent per annum, rest of the districts experienced no conspicuous change over this period.

Growth analysis of current fallows showed that Sirmaur and Solan traced increasing annual growth rates of 2.70 per cent and 2.23 per cent while Kangra recorded a negative growth (8.97% p.a.) over the first period of study. The second period demonstrated a different scenario, current fallows went up in Kangra, Kullu, Mandi and Shimla at the rate of 1.90 per cent, 2.58 per cent, 11.61 per cent and 2.87 per cent per annum, respectively, whereas it decelerated in Hamirpur (2.65% p.a.) and Una (3.32% p.a.). The entire period depicted a different image: Mandi, Shimla, Sirmaur and Solan witnessed an increase in current fallows with annual growth rates ranging from 1.43 per cent to 5.54 per cent which was the highest for Mandi and the Lowest for Solan. However,

Hamirpur and Lahaul & Spiti registered a per annum decline of 1.04 per cent and 2.74 per cent in current fallows, respectively. As regards the growth of other fallows, it grew up in most of the districts with growth rates varying from 2.27 per cent to 12.75 per cent per annum such that Bilaspur secured the lowest and Hamirpur the highest growth rate during the overall period of study. During the first period, Bilaspur, Kinnaur, Mandi, Shimla, Sirmaur and Una were among the districts that recorded increasing growth rates in other fallows ranging from 3.08 per cent per annum in Shimla to 30.04 per cent per annum in Una. The scenario in the second period demonstrated a rising trend in other fallows in Hamirpur (10.82% p.a.), Shimla (9.90% p.a.) and Sirmaur (8.50% p.a.) whereas a decline in Kangra (8.89% p.a.), Kinnaur (9.69% p.a.) and Una (12.10% p.a.).

Trend analysis of culturable waste over the entire study period revealed that it went up in most of the districts with annual growth rates ranging from 0.27 per cent in Sirmaur to 3.93 per cent in Lahaul & Spiti. However, Kangra was the only exception registering a decline (3.33% p.a.) in culturable waste. The first period provided quite a different image demonstrating that Bilaspur, Hamirpur and Kullu experienced increase in culturable waste registering growth rates of 3.67 per cent, 2.87 per cent and 7.56 per cent per annum, in that order, whereas Chamba, Mandi, Shimla and Sirmaur recorded decelerated growth rates of 0.48 per cent, 0.78 per cent, 1.08 per cent and 0.44 per cent per annum, respectively. Besides, during the second period, Kullu and Lahaul & Spiti registered negative growth of 1.76 per cent and 1.18 per cent per annum, in that order, while half of the districts secured increasing annual growth rates ranging from 0.93 per cent in Solan to 6.31 per cent in Una. As far as trend analysis of area put to non-agricultural uses was concerned, over the entire period of study, majority of the districts depicted increasing trends with yearly growth rates varying from 0.52 per cent in Sirmaur to 19.14 per cent in Kinnaur. However, Bilaspur, Chamba and Solan were the districts that registered declining growth rates of 0.77 per cent, 0.64 per cent, and 1.44 per cent per annum, respectively, but there was no significant change in rest of the districts. A special trend was observed in the first period such that an equal number of districts experienced rising (Hamirpur, Kinnaur, Mandi and Shimla), decelerating (Bilaspur, Chamba, Solan and Una) and no considerable change (in rest of the districts) with annual growth rates ranging from 1.91 per cent to 11.20 per cent and -0.97 per cent to -5.49 per cent for the first and second categories, respectively. Moreover, during the second period Kinnaur, Kullu, Lahaul & Spiti, Shimla, Sirmaur and Una depicted upward trends registering annual growth rates ranging from 0.65 per cent in Sirmaur to 35.08 per cent in Lahaul & Spiti whereas no significant change was observed in rest of the districts.

Table 4.1.2 District-wise Compound Annual Growth Rates of Land Use in Himachal Pradesh, 1972-73 to 2007-08. ***(per cent per annum)***

Period[7]	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Himachal Pradesh									
P_1	0.93** (0.07)	2.93** (0.19)	2.29** (0.31)	$0.13^{n.s}$ (0.66)	$-0.03^{n.s}$ (1.07)	$-0.01^{n.s}$ (0.27)	$-0.26^{n.s}$ (0.33)	-1.26** (0.39)	13.72** (1.54)	0.37** (0.05)
P_2	2.21** (0.34)	0.39** (0.06)	11.12** (2.64)	6.51** (0.57)	$0.52^{n.s}$ (0.28)	1.92** (0.26)	$2.02^{n.s}$ (1.00)	1.44** (0.24)	-2.44* (0.90)	-0.55** (0.06)
O	1.54** (0.10)	1.74** (0.12)	6.21** (0.72)	2.54** (0.35)	-0.66* (0.28)	0.96** (0.12)	1.64** (0.28)	0.61** (0.17)	4.72** (0.81)	-0.14** (0.04)
	Bilaspur									
P_1	0.003** (0.001)	-0.33** (0.03)	3.86** (0.46)	-0.97** (0.18)	3.67** (0.39)	-0.48** (0.06)	$2.40^{n.s}$ (1.44)	$1.45^{n.s}$ (1.06)	5.76** (1.81)	$0.06^{n.s}$ (0.07)
P_2	-0.25** (0.04)	1.31** (0.12)	-2.85** (0.54)	$0.15^{n.s}$ (0.52)	2.05** (0.34)	-0.69** (0.21)	$0.64^{n.s}$ (0.37)	$-0.84^{n.s}$ (1.14)	$1.31^{n.s}$ (0.91)	-0.40** (0.09)
O	-0.09** (0.01)	0.46** (0.08)	$0.56^{n.s}$ (0.34)	-0.77** (0.15)	2.31** (0.15)	-0.32** (0.06)	1.00** (0.37)	$-0.59^{n.s}$ (0.40)	2.27** (0.53)	-0.16** (0.03)
	Chamba									
P_1	-0.85* (0.31)	8.00** (1.19)	5.75** (0.69)	-1.29** (0.12)	-0.48** (0.10)	-4.11** (0.50)	-	$0.36^{n.s}$ (0.73)	$1.18^{n.s}$ (0.96)	0.23* (0.10)
P_2	$0.00005^{n.s}$ (0.00003)	0.012** (0.002)	0.66** (0.17)	$0.19^{n.s}$ (0.14)	$0.29^{n.s}$ (0.21)	-0.03** (0.01)	-	$-0.60^{n.s}$ (0.45)	$0.11^{n.s}$ (3.08)	$-0.57^{n.s}$ (0.33)
O	-0.23* (0.09)	2.65** (0.45)	3.13** (0.27)	-0.64** (0.08)	0.45** (0.08)	-1.39** (0.23)	[8]-10.06** (3.00)	$-0.32^{n.s}$ (0.21)	$0.64^{n.s}$ (0.79)	$-0.03^{n.s}$ (0.09)

[7] P_1 = First Period (1972-73 to 1989-90), P_2 = Second Period (1990-91 to 2007-08), and O = Overall Period (1972-73 to 2007-08).
[8] It is computed for the period 1975-76 to 2000-01.

Contd... *per cent per annum*

Period	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Hamirpur									
P_1	-0.08** (0.02)	0.17$^{n.s}$ (0.79)	-2.67** (0.82)	1.91* (0.75)	2.87** (0.64)	-11.99** (4.00)	-	0.50$^{n.s}$ (0.55)	-	-0.42* (0.20)
P_2	0.019** (0.003)	-0.72** (0.11)	-1.30* (0.57)	0.13$^{n.s}$ (0.26)	2.80* (1.02)	26.06** (3.45)	-	-2.65** (0.56)	10.82** (2.31)	-0.57** (0.08)
O	-0.008$^{n.s}$ (0.007)	0.31$^{n.s}$ (0.21)	-0.58$^{n.s}$ (0.29)	1.30** (0.21)	0.37$^{n.s}$ (0.37)	-0.64$^{n.s}$ (2.07)	-	-1.04** (0.23)	[9]12.75** (2.78)	-0.50** (0.05)
	Kangra									
P_1	0.85** (0.18)	0.87$^{n.s}$ (0.47)	1.61$^{n.s}$ (1.17)	1.58$^{n.s}$ (2.10)	-0.90$^{n.s}$ (1.97)	5.47** (1.31)	-	-8.97** (1.90)	-	0.58* (0.22)
P_2	0.01$^{n.s}$ (0.02)	0.24** (0.08)	-5.44**[10] (1.40)	-0.23$^{n.s}$ (0.16)	-0.23$^{n.s}$ (0.16)	2.27$^{n.s}$ (1.28)	5.67$^{n.s}$ (4.47)	1.90** (0.33)	-8.89* (3.81)	-0.15$^{n.s}$ (0.08)
O	0.23** (0.06)	0.26* (0.12)	-	0.85$^{n.s}$ (0.51)	-3.33** (0.52)	6.69** (0.55)	[11]28.94** (6.42)	-1.20$^{n.s}$ (0.74)	-	0.04$^{n.s}$ (0.07)

[9] It is computed for the period 1985-86 to 2007-08.
[10] It is computed for the period 1996-97 to 2007-08.
[11] It is computed for the period 1983-84 to 2007-08.

Contd... *per cent per annum*

Periods	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Kinnaur									
P_1	20.44** 3.18	[12]84.08** (13.80)	20.60** (3.24)	11.20* (4.74)	-0.93[n.s] (1.39)	[13]44.74** (6.38)	-	0.49[n.s] (1.09)	[14]13.15** (1.94)	-3.11* (1.31)
P_2	7.81** (1.01)	3.34** (0.62)	11.84** (2.20)	24.88** (3.41)	-0.86[n.s] (1.73)	5.53** (0.72)	-1.57[n.s] (3.16)	2.90[n.s] (1.57)	-9.69** (2.22)	0.15[n.s] (0.09)
O	12.28** (0.94)	[15]22.64** (3.64)	16.61** (1.01)	19.14** (1.58)	1.69** (0.61)	[16]17.20** (2.06)	[17]0.47[n.s] (1.74)	0.68[n.s] (0.48)	-1.29[n.s18] (1.22)	-0.95* (0.36)
	Kullu									
P_1	2.52[n.s] (1.25)	-	5.83** (1.26)	-1.29[n.s] (3.14)	7.56* (2.63)	-	[19]-6.74** (1.17)	0.73[n.s] (1.19)	-	3.11* (1.44)
P_2	0.14[n.s] (0.09)	-	-10.31** (1.74)	6.82** (1.40)	-1.76** (0.28)	-	4.69* (1.89)	2.58** (0.40)	-	0.78[n.s] (0.44)
O	0.73* (0.32)	-	-3.14** (0.87)	1.24[n.s] (0.92)	2.62** (0.73)	-	[20]-0.32[n.s] (0.74)	0.39[n.s] (0.34)	-	0.93* (0.38)

[12] It is computed for the period 1975-76 to 1989-90.
[13] It is computed for the period 1973-74 to 1989-90.
[14] It is computed for the period 1973-74 to 1989-90.
[15] It is computed for the period 1975-76 to 2007-08.
[16] It is computed for the period 1973-74 to 2007-08.
[17] It is computed for the period 1981-82 to 2007-08.
[18] It is computed for the period 1973-74 to 2007-08.
[19] It is computed for the period 1973-74 to 1989-90.
[20] It is computed for the period 1973-74 to 2007-08

Contd... *per cent per annum*

Period	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Lahaul & Spiti									
P_1	13.36* (5.18)	[21]4.51$^{n.s}$ (3.89)	17.55** (2.41)	2.82$^{n.s}$ (1.57)	7.56$^{n.s}$ (4.27)	15.79* (6.95)	-6.75$^{n.s}$ (5.83)	-0.50$^{n.s}$ (4.06)	-	1.39** (0.25)
P_2	11.31** (2.09)	1.55** (0.28)	41.49** (9.90)	35.08** (5.24)	-1.18** (0.40)	6.41** (1.18)	-0.01$^{n.s}$ (1.54)	[22]-3.01$^{n.s}$ (2.00)	-	0.33* (0.13)
O	9.30** (1.34)	[23]9.69** (1.15)	28.84** (2.49)	12.59** (1.81)	3.93** (1.08)	4.87** (1.70)	-2.45$^{n.s}$ (1.55)	[24]-2.74* (1.13)	-	0.63** (0.09)
	Mandi									
P_1	-0.02$^{n.s}$ (0.01)	0.61** (0.08)	-1.97** (0.62)	3.46** (0.75)	-0.78** (0.23)	-1.44** (0.10)	6.59** (1.44)	1.30$^{n.s}$ (0.74)	7.05** (2.37)	0.79** (0.13)
P_2	0.016** (0.002)	0.20** (0.03)	-3.05$^{n.s}$ (5.70)	-	-0.27$^{n.s}$ (0.36)	-0.26** (0.05)	8.03* (3.03)	11.61** (1.55)	-5.15$^{n.s}$ (2.48)	-0.79** (0.11)
O	0.002$^{n.s}$ (0.003)	0.65** (0.04)	-0.67$^{n.s}$ (1.43)	[25]1.55** (0.55)	0.48** (0.15)	-1.19** (0.07)	2.82** (0.89)	5.54** (0.60)	2.82** (1.03)	-0.07$^{n.s}$ (0.08)
	Shimla									
P_1	2.59** (0.34)	4.68** (0.77)	2.29** (0.14)	4.08** (1.06)	-1.08** (0.33)	2.77** (0.39)	3.37$^{n.s}$ (1.73)	0.73$^{n.s}$ (0.72)	3.08** (0.74)	0.74** (0.07)
P_2	1.36** (0.15)	1.32** (0.08)	-1.12$^{n.s}$ (1.86)	3.78** (1.01)	3.54** (0.64)	1.63** (0.27)	7.90* (2.74)	2.87** (0.63)	9.90** (1.80)	-0.71** (0.06)
O	2.12** (0.11)	3.76** (0.25)	1.50** (0.49)	1.87** (0.40)	0.30$^{n.s}$ (0.27)	2.26** (0.13)	4.84** (0.80)	3.13** (0.29)	4.72** (0.56)	-0.06$^{n.s}$ (0.07)

[21] It is computed for the period 1974-75 to 1989-90.
[22] It is computed for the period 1990-91 to 2006-07.
[23] It is computed for the period 1974-75 to 2007-08.
[24] It is computed for the period 1972-73 to 2006-07.
[25] It is computed for the period 1972-73 to 1997-98.

Contd... *per cent per annum*

Period	Land Use Categories									
	Reporting Area	Forests	Barren	Non-agril. Uses	Culturable Waste	Permanent Pastures	Misc. Tree Crops	Current Fallows	Other Fallows	Net Sown Area
	Sirmaur									
P_1	-0.0019* (0.0009)	0.081* (0.036)	0.47** (0.14)	0.19$^{n.s}$ (0.12)	-0.44** (0.09)	-0.13$^{n.s}$ (0.10)	-0.24$^{n.s}$ (0.18)	2.70** (0.35)	5.30** (0.66)	0.04$^{n.s}$ (0.06)
P_2	-0.0019* (0.0007)	-0.013$^{n.s}$ (0.015)	0.69** (0.12)	0.65** (0.09)	1.06** (0.30)	-0.54** (0.08)	0.06$^{n.s}$ (0.06)	0.49$^{n.s}$ (0.54)	8.50** (1.12)	-0.37** (0.06)
O	-0.0002$^{n.s}$ (0.0003)	0.001$^{n.s}$ (0.011)	0.67** (0.05)	0.58** (0.04)	0.27* (0.10)	-0.38** (0.04)	0.14* (0.05)	1.61** (0.18)	5.70** (0.36)	-0.23** (0.03)
	Solan									
P_1	-0.07$^{n.s}$ (0.05)	-0.24** (0.05)	5.47** (1.39)	-5.49** (1.32)	0.45$^{n.s}$ (0.53)	0.72** (0.13)	-7.37** (1.22)	2.23** (0.62)	1.93$^{n.s}$ (1.73)	-0.18$^{n.s}$ (0.13)
P_2	0.016** (0.002)	0.07** (0.02)	1.63** (0.49)	0.44$^{n.s}$ (0.37)	0.93** (0.27)	-0.23** (0.05)	-3.58$^{n.s}$ (2.34)	-0.03$^{n.s}$ (0.58)	2.01$^{n.s}$ (1.18)	-0.40** (0.06)
O	-0.015$^{n.s}$ (0.012)	0.06** (0.02)	3.09** (0.39)	-1.44** (0.46)	0.46** (0.15)	0.13* (0.05)	-5.82** (0.65)	1.43** (0.23)	3.28** (0.53)	-0.47** (0.04)
	Una									
P_1	-	-0.82** (0.13)	0.73$^{n.s}$ (0.36)	-3.60** (0.52)	0.34$^{n.s}$ (0.65)	-0.10$^{n.s}$ (0.37)	-	0.25$^{n.s}$ (0.48)	30.04** (5.50)	0.37** (0.06)
P_2	0.04** (0.01)	-3.74** (0.52)	-2.53** (0.43)	4.03* (1.43)	6.31** (0.74)	4.74** (0.57)	36.74** (5.11)	-3.32** (1.12)	-12.10** (2.52)	-1.01** (0.13)
O	0.015** (0.002)	-1.70** (0.19)	-0.65** (0.20)	-0.42$^{n.s}$ (0.48)	2.16** (0.36)	2.13** (0.26)	[26]25.52** (2.65)	-0.69$^{n.s}$ (0.35)	5.26* (2.20)	-0.35** (0.07)

Note: (**) denotes significance at 1% probability level. (*) denotes significance at 5% probability level. (n.s) denotes non-significance at 5% probability level. Figures in brackets denote standard errors of growth rates.

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, and Statistical Outline of Himachal Pradesh, 2009-10, Department of Economics and Statistics, Shimla-9, Government of Himachal Pradesh.

[26] It is computed for the period 1981-82 to 2007-08.

4.2. Land Holding

Land is one of the natural resources which have been widely used in farming activities. It is among the few readily available inputs at the disposal of farmers and is crucial in production as farming is mostly carried out on land. However, the size of land under plough, *inter alia*, directly affects production potential of crops and hence income of the farmers especially in hilly areas where cultivable land is scarce and subject to erosions by water and wind. Table 4.2.1 displays district-wise changes in operational holdings in Himachal Pradesh during 1970-71 to 2005-06. The table shows that during 1970-71, 6.09 *lakh* farmers were cultivating 9.30 *lakh* hectares of the land with an average holding of 1.53 hectares per farmer all over the state. The scenario changed in 1995-96 when 8.63 *lakh* farmers were growing on 10 *lakh* hectares of the land with average holding of 1.16 hectares per farmer. By 2005-06 the image was quite different: 9.33 *lakh* farmers were practicing agriculture on 9.68 *lakh* of the land with average holding of 1.04 hectares per farmer. It was observed at the state and most of the district that overtime the number of farmers increased whereas the area available for cultivation registered an increase up to 1995-96 but it declined slightly in 2005-06. As a result, the size of holdings continued to decline which made them uneconomic and unprofitable for farming. Besides, due to lack of land consolidation, the holdings are scattered and often unmanageable. Land lease and tenancy regulations, on the other hand, do not allow farming on large areas in the state (HPDR 2005).

So far as the average size of operational holding is concerned, among others, Sirmaur, Solan, Lahaul & Spiti and Kinnaur recorded and sustained first, second, third and fourth positions during 1970-71 to 2005-06, respectively. In 1970-71 holding size in Sirmaur and Solan was greater than two hectares while except Kullu where holding size was less than one hectare, all others districts had holding size ranging from one to two hectares. During 1995-96 only Sirmaur had holding size greater than two hectares whereas Chamba, Kangra, Kullu and Mandi had holding size of less than one hectare. In the remaining districts holding size was between one and two hectares. The scenario in 2005-06 depicted that Sirmaur sustained its holding size of greater than two hectares while Bilaspur joined the districts with holding size of less than one hectare. The rest of the districts secured holding size in the range of one to two hectares. It implies that overtime the holding size became smaller and smaller and marginal farmers grew rapidly in the state which is a great challenge to agricultural development in the state.

Table 4.2.1 Changes in Operational Holdings in Himachal Pradesh, 1970-71 to 2005-06.

Sr. No.	Districts	Agriculture Census								
		1970-71			1995-96			2005-06		
		Number (lakh)	Area (lakh ha)	Average Size (ha/farmer)	Number (lakh)	Area (lakh ha)	Average Size (ha/farmer)	Number (lakh)	Area (lakh ha)	Average Size (ha/farmer)
1	Bilaspur	0.32	0.46	1.46	0.49	0.53	1.08	0.56	0.52	0.92
2	Chamba	0.49	0.54	1.11	0.65	0.57	0.88	0.70	0.55	0.79
3	Hamirpur	0.46	0.72	1.57	0.69	0.77	1.11	0.73	0.74	1.01
4	Kangra	1.34	2.18	1.62	2.24	2.10	0.94	2.30	2.04	0.89
5	Kinnaur	0.07	0.12	1.86	0.10	0.14	1.48	0.11	0.14	1.37
6	Kullu	0.52	0.40	0.78	0.57	0.44	0.78	0.68	0.42	0.63
7	Lahaul & Spiti	0.03	0.05	1.90	0.04	0.06	1.62	0.04	0.06	1.54
8	Mandi	0.96	1.17	1.22	1.37	1.30	0.95	1.50	1.29	0.86
9	Shimla	0.63	1.12	1.78	0.90	1.26	1.40	1.10	1.25	1.13
10	Sirmaur	0.33	0.79	2.43	0.45	1.03	2.28	0.49	0.99	2.02
11	Solan	0.38	0.87	2.26	0.50	0.92	1.85	0.50	0.87	1.73
12	Una	0.58	0.88	1.53	0.64	0.89	1.39	0.63	0.81	1.29
Himachal Pradesh		**6.09**	**9.31**	**1.53**	**8.63**	**10.00**	**1.16**	**9.33**	**9.68**	**1.04**

Source: Statistical Outline of Himachal Pradesh (various issues), Department of Economics & Statistics, Shimla-9, Government of Himachal Pradesh.

A usual practice in most of the countries and regions is to classify farmers into various categories based on the land at their disposal. It is helpful in designing plans, strategies and policies for agricultural development because the socio-economic conditions differ in each case. Hence, farmers in Himachal Pradesh are categorized into five classes based on their land holding size i.e. marginal farmers, small farmers, semi-medium farmers, medium farmers and large farmers. Table 4.2.2 depicts categories of farmers based on holding size in Himachal Pradesh for 2005-06. It can be seen that although most of the farmers (68.21%) in the state were marginal but they had only 26.67 per cent (almost one-fourth) of the cultivable land with them. The next largest category was small farmers (18.82%) cultivating about one fourth (25.27%) of the cultivable land which is nearly the same as that of marginal farmers. Furthermore, semi-medium farmers occupied the third position (9.48%) but have almost equal share of the cultivable land (24.82%) as that of marginal and small farmers. Higher positions showed more inequalities, medium farmers constituted only 3.12 per cent but accounted for 17.07 per cent of cultivable land. Similarly, large farmers were less than half per cent (0.38%) but were having 6.20 per cent of the total land. It could be concluded that wide range of inequalities and disparities existed in the arena of land distribution in the state which is no doubt a threat to the growth and viability of marginal and small farmers at least in the medium to long run.

Table 4.2.2 Categories of Farmers Based on Holding Size in Himachal Pradesh, 2005-06.

Sr. No.	Category	Size Class (ha)	Number ('000)	Percentage	Area ('000 ha)	Percentage
1	Marginal Farmers	<0.05	418.78	44.87	103.64	10.70
		0.05 – 1.0	217.84	23.34	154.60	15.97
		Sub-Total	636.62	68.21	258.25	26.67
2	Small Farmers	1.0 – 2.0	175.65	18.82	244.74	25.27
3	Semi-Medium Farmers	2.0 – 3.0	62.26	6.67	150.36	15.53
		3.0 – 4.0	26.19	2.81	89.99	9.29
		Sub-Total	88.45	9.48	240.36	24.82
4	Medium Farmers	4.0 – 5.0	12.91	1.38	57.26	5.91
		5.0 – 7.5	12.17	1.30	72.97	7.54
		7.5 – 10.0	4.06	0.43	34.77	3.59
		Sub-Total	29.14	3.12	164.99	17.04
5	Large Farmers	10.0 – 20.0	3.08	0.33	39.63	4.09
		>20.0	0.45	0.05	20.37	2.10
		Sub-Total	3.53	0.38	60.01	6.20

Source: Statistical Outline of Himachal Pradesh, Department of Economics & Statistics, Shimla-9, Government of Himachal Pradesh.

4.3. Cropping Pattern

Changes in cropping pattern in terms of acreage allocation among different crops are the integral part of agricultural development of any region. Cropping pattern means the proportion of area under various crops at a point of time. It is a dynamic concept for cropping pattern changes overtime and across space. Himachal Pradesh is in no way exception. Cropping pattern of a region is closely influenced by the geo-climatic, socio-economic, historical and political factors (Nalawade *et al.* 2010). Hence, in the present study an attempt has been made to capture the cropping pattern changes that have taken place during the past four decades or so in the state as well as the districts.

4.3.1. Trends in Cropping Pattern

Cropping patterns in terms of area under major crops and crop groups underwent tremendous change both at the state and district levels during the last four decades or so. Table 4.3.1 portrays changes in cropping pattern in Himachal Pradesh during, 1972-73 to 2004-05. It can be seen from the table that percentage share of rice, 'other cereals', pulses and foodgrains in total cropped area came down continuously by 2.19 per cent points, 6.60 per cent points, 5.27 per cent points and 6.65 per cent points, respectively. Similarly, the area share of potato and oilseeds declined slightly while that of fodder increased marginally. An increase of 3.10 per cent points, 4.31 per cent points, 3.53 per cent points, 1.30 per cent points and 2.53 per cent points was observed in area under maize, wheat, apple, other fruits and vegetables other than potato, in that order, during the study period. It can be concluded that cropping pattern has shifted in favour of horticultural crops (apple, other fruits and other vegetables) and major cereals (maize and wheat) in the state during the study period.

Analysis of changes in cropping pattern at the district level for the period from 1972-73 to 2004-05 revealed that area under rice as percentage of total cropped area declined in most of the districts. The lowest decline was observed in Chamba (0.51 per cent points) while the highest was seen in Mandi (4.85 per cent points). Contrarily, Kinnaur, Sirmaur and Solan were among the districts where per cent share of area under rice increased. The lowest increase was recorded in Kinnaur (0.11 per cent points) whereas the highest was observed in Solan (2.02 per cent points). Further, the area share of maize in total cropped area grew up in majority of the districts. Hamirpur recorded the highest increase (9.61 per cent points) while the least increase was observed in Kinnaur (0.48 per

cent points). The area under maize witnessed the highest decline of 4.77 per cent points in Shimla district. Here it is important to point out that while most of the increase in area under maize in various districts took place during the period 1972-73 to 1988-89. The decline in maize acreage in Shimla was observed during the period 1988-89 to 2004-05. The former could be attributed to the fall in area under other *kharif* cereals, pulses and oilseeds during 1972-73 to 1988-89 and consequent substitution by maize, the latter could be ascribed to shift in area towards vegetable crops during 1988-89 to 2004-05 in Shimla district.

As a percentage of total cropped area, wheat acreage increased in most of the districts. While Kangra registered the lowest increase (4.17 per cent points), Hamirpur secured the highest increase in area under wheat (21.4 per cent points). The decline in wheat area was substantial in Lahaul & Spiti (16.51 per cent points), Shimla (15.11 per cent points) and Kinnaur (9.82 per cent points) during the study period. And it might be attributed to the diversification towards vegetables and other cash crops in these high hill districts. Besides, area under 'other cereals' as percentage of gross cropped area declined continuously in all the districts such that the lowest decline was observed in Bilaspur (0.03 per cent points) and the highest was seen in Kinnaur (39.22 per cent points). Pulses were among the crops whose share in gross cropped area came down in the majority of districts. The largest decline was seen in Una (17.65 per cent points) and the smallest was observed in Chamba (0.28 per cent points). However, it increased in Kinnaur, Lahaul & Spiti and Shimla by 7.24, 0.49 and 0.38 per cent points, in that order. Most of the fall in area under 'other cereals' and pulses was observed during 1972-73 to 1988-89 when the delayed green revolution was showing its presence in terms of maize-wheat based cropping system. Thus, area put to foodgrains as percentage of gross cropped area declined in most of the districts. The lowest decline was observed in Una (1.1 per cent points) while the highest was recorded in Lahaul & Spiti (49.61 per cent points). However, Bilaspur, Hamirpur and Kangra registered a marginal increase in area under foodgrains. It is worth mentioning that foodgrains occupied the largest portion of gross cropped area in majority of districts (except in Lahaul & Spiti, 25.57%) ranging from 48.51 per cent in Shimla to 98.83 per cent in Hamirpur.

Among the apple growing districts, except Mandi that recorded a slight decline (1.09 per cent points) in the share of area under apple, the remaining districts registered an increase which was the maximum in Shimla (27.62 per cent points) and Kinnaur (26.71 per

cent points). Likewise, the share of area under fruits other than apple grew up in all the districts with Kinnaur achieving the highest increase (3.48 per cent points). As far as, the share of area under potato is concerned it went up and declined in almost equal number of districts (7 versus 5). That is to say, it increased in Bilaspur, Chamba, Kangra, Lahaul & Spiti, Mandi, Sirmaur and Una, with the largest hike observed in Lahaul & Spiti (8.06 per cent points). It decreased in Hamirpur, Kinnaur, Kullu, Shimla and Solan such that the highest decline was observed in Shimla (2.35 per cent points). The share in total cropped area of vegetables other than potato (other vegetables) increased in most of the districts. The highest increase was recorded in Lahaul & Spiti (38.33 per cent points) and Kinnaur (12.02 per cent points) while the smallest increase was registered in Kangra (0.03 per cent points).

As regards the area under oilseeds, it decreased in Bilaspur, Hamirpur, Kangra, Kinnaur and Solan districts with Kangra experiencing the highest decline (3.27 per cent points). However, it increased in rest of the districts. Among the fodder growing districts, except Kangra and Solan that registered a marginal decline of 0.19 per cent points and 0.14 per cent points, respectively, the remaining districts experienced increase of various levels in area under fodder crops. The increase was the highest in Sirmaur (1.71 per cent points) and the lowest in Chamba (0.01 per cent points). The upward growth in area under fodder crops implies that raising livestock increased side by side with farming in most of the districts, during the study period.

In conclusion, the observations demonstrated that cropping pattern underwent a profound shift over the years of study, 1972-73 to 2004-05. Farmers extracted their land resources from producing rice, 'other cereals' including barley and pulses in most of the districts and allocated it towards producing the major cereals (maize and wheat), horticultural crops (apple, fruits other than apple, and vegetables other than potato), and in some small degrees to oilseeds, potato and fodder crops. Thus, the cropping pattern changed in favour of high value cash crops and crops which are essential for food security and feeding animals. It may be inferred that the motive behind this shift in cropping pattern could be, *inter alia*, at the first place relative profit and food security concerns.

Table 4.3.1 Cropping Pattern Trends in Himachal Pradesh, 1972-73 to 2004-05. *per cent to total cropped area*

Years	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Himachal Pradesh											
1972-73	10.54	28.16	34.27	10.46	7.76	91.19	1.27	0.52	1.56	0.54	2.58	1.00
1988-89	9.64	32.06	37.97	5.59	4.45	89.72	3.08	0.58	1.58	1.09	2.13	0.92
2004-05	8.35	31.26	38.58	3.86	2.49	84.54	4.80	1.82	1.55	3.07	1.88	1.07
	Bilaspur											
1972-73	6.87	39.05	35.17	0.44	15.47	97.00	0.00	0.21	0.02	0.39	1.23	0.21
1988-89	5.29	43.42	43.43	0.71	3.97	96.82	0.00	0.49	0.03	0.38	1.60	0.33
2004-05	2.60	44.54	48.81	0.41	0.79	97.15	0.00	0.59	0.03	0.68	0.87	0.28
	Chamba											
1972-73	4.79	40.10	26.64	16.78	5.33	93.64	0.04	0.47	0.85	0.27	4.36	0.01
1988-89	4.55	43.10	29.79	10.37	5.30	93.12	1.95	0.08	0.81	0.25	3.68	0.00
2004-05	4.28	43.57	31.02	7.65	5.05	91.58	1.50	0.48	1.06	0.64	4.64	0.02
	Hamirpur											
1972-73	8.04	36.27	28.11	18.52	7.68	98.62	0.00	0.01	0.03	0.32	0.46	0.05
1988-89	4.85	43.21	48.89	0.26	2.00	99.20	0.00	0.03	0.01	0.09	0.24	0.16
2004-05	3.23	45.88	49.51	0.11	0.11	98.83	0.00	0.15	0.01	0.31	0.17	0.38
	Kangra											
1972-73	17.72	23.53	39.15	2.62	5.76	88.79	0.00	0.38	0.47	0.41	6.33	1.83
1988-89	20.06	25.40	41.15	2.23	3.07	91.90	0.00	0.55	0.43	0.41	4.76	1.22
2004-05	17.01	26.63	43.32	1.31	1.66	89.93	0.00	2.83	0.75	0.44	3.06	1.64

Contd... *per cent to total cropped area*

Years	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Kinnaur											
1972-73	0.34	2.43	13.81	72.83	2.51	91.91	1.15	3.13	3.27	0.33	0.05	0.00
1988-89	0.17	5.83	9.13	53.69	6.99	75.81	11.60	5.61	3.29	3.09	0.25	0.00
2004-05	0.45	2.91	3.99	33.61	9.75	50.71	27.86	6.61	2.02	12.35	0.00	0.00
	Kullu											
1972-73	6.94	22.41	33.30	24.62	5.71	92.99	2.48	0.06	2.13	0.43	1.12	0.05
1988-89	4.07	28.22	35.70	11.40	6.56	85.95	8.05	1.03	2.00	1.40	1.08	0.09
2004-05	2.38	25.37	39.07	7.06	4.25	78.13	12.09	2.24	1.98	3.20	1.21	0.11
	Lahaul & Spiti											
1972-73	0.00	0.00	18.83	56.07	0.28	75.18	0.08	0.00	13.69	8.02	0.64	0.00
1988-89	0.00	0.86	7.66	29.56	0.18	38.27	0.43	0.00	35.47	21.96	0.31	0.00
2004-05	0.00	2.44	2.32	20.03	0.77	25.57	2.03	0.43	21.75	46.35	1.95	0.00
	Mandi											
1972-73	17.52	24.81	37.71	10.07	4.00	94.11	1.74	0.70	1.15	0.29	0.68	0.39
1988-89	14.63	29.14	40.30	4.82	3.84	92.73	2.40	0.75	1.24	1.36	0.75	0.40
2004-05	12.67	29.34	41.93	3.46	2.19	89.60	0.65	3.14	1.55	3.06	0.72	0.57
	Shimla											
1972-73	5.48	19.52	31.14	22.25	4.46	82.84	7.03	0.00	8.11	1.61	0.16	0.01
1988-89	4.44	21.07	26.87	15.05	4.97	72.40	17.11	0.04	7.05	2.65	0.49	0.00
2004-05	2.10	14.75	16.03	10.78	4.84	48.51	34.65	0.67	5.76	9.04	0.73	0.04

Contd... *per cent to total cropped area*

Years	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Sirmaur											
1972-73	6.62	31.79	36.90	7.68	7.01	90.01	0.59	1.87	0.95	0.21	1.55	0.66
1988-89	6.43	33.72	37.39	5.26	4.96	87.77	1.06	0.79	1.72	1.20	1.31	2.27
2004-05	7.27	31.17	34.09	3.99	2.63	79.15	0.71	1.63	1.94	5.44	2.05	2.37
	Solan											
1972-73	5.28	34.31	30.93	2.86	16.89	90.27	0.00	1.05	0.28	1.15	3.65	2.18
1988-89	5.17	36.66	36.50	2.74	9.55	90.62	0.02	1.14	0.14	2.59	2.32	2.21
2004-05	7.30	35.17	38.00	2.59	3.11	86.16	0.06	1.36	0.13	6.73	2.27	2.04
	Una											
1972-73	3.92	36.70	33.06	0.06	18.48	92.21	0.00	0.26	0.14	0.39	1.18	3.73
1988-89	2.74	44.87	40.28	0.06	3.21	91.16	0.00	0.45	0.40	0.58	2.59	2.60
2004-05	2.82	42.20	45.25	0.004	0.83	91.11	0.00	0.86	1.11	0.87	1.88	2.87

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

4.3.2. Trends in Production, Area and Yield

Researchers are often interested in analyzing the trends in production, area and yields while studying agricultural development. Hence, production, area and yield are the three important indicators of measuring agricultural development of any country or region. Production in agriculture can be increased, *inter alia,* either by increase in area under plough or the increase in yield. Expansion of area is often not possible particularly in the hilly regions, except by incurring exorbitant cost or at the cost of destroying forests and range lands. That is why greater emphasis is put on increasing agricultural productivity. Therefore, an attempt was made in the present study to analyze the changes in production, area and yield of major crops and crop groups in Himachal Pradesh. To capture these changes both triennium endings as well as compound annual growth rates were computed. This section is devoted to discuss trends in production, area and yield in terms of triennium endings but the compound annual growth rates of production, area and yield are delineated subsequently (*see Section 4.3.3.).* Table 4.3.2 depicts trends in production, area and yield of major crops and crop groups in Himachal Pradesh during a period of time from 1972-73 to 2004-05. It can be realized from the table that at the state level production of rice went up from 101.675 thousand tonnes in triennium ending 1974-75 to 105.135 thousand tonnes in 2004-05; however, a decline to 86.825 thousand tonnes was observed during triennium ending 1989-90. Area under rice declined from 96.058 thousand hectares in 1974-75 to 81.379 thousand hectares in 2004-05. The yield of rice declined to 0.952 tonne per hectare (t/ha) during 1989-90 but it increased from 1.058 t/ha to 1.292 t/ha between 1974-75 and 2004-05. This implied that the increase in rice production during the study period was due to a rise in yield despite a fall in rice acreage.

The production of maize increased from 452.261 thousand tonnes to 616.399 thousand tonnes between 1974-75 and 2004-05. Though area under maize went up from 261.976 thousand hectares in 1974-75 to 296.372 thousand hectares in 2004-05, yet a decline from 309.579 thousand hectares was evident after 1989-90. The yield of maize decreased from 1.726 t/ha to 1.688 t/ha between 1974-75 and 1989-90. However, it increased substantially to 2.080 t/ha in 2004-05. It can be concluded that the increase in production of maize during 1989-90 was more due to increase in area but it appeared to be more due to rise in yield during 2004-05. However, production of wheat showed an increase from 330.228 thousand tonnes in 1974-75 to 559.980 thousand tonnes during 2004-05. Acreage put to wheat production also went up from 315.740 thousand hectares to

363.433 thousand hectares over the same period with a decline from 1989-90 onwards. The yield of wheat increased from 1.046 t/ha in 1974-75 to 1.541 t/ha in 2004-05. It was noticed that the increase in wheat production was explained by both rise in area and yield in 1989-90 but the increase in wheat production was more due to increase in its yield in 2004-05.

Production of barley declined considerably from 48.783 thousand tonnes in 1974-75 to 30.822 thousand tonnes during 2004-05. Over the same period, area allocated to barley production declined from 41.594 thousand hectares to 24.044 thousand hectares while the yield of barley grew up from 1.173 t/ha to 1.282 t/ha. The decline in barley production was observed to be more due to decline in area while it was boosted by improvement in its productivity. Likewise, production of 'other cereals' decreased from 32.121 thousand tonnes in 1974-75 to 8.792 thousand tonnes in 2004-05, its level remaining almost stagnant from 1989-90 onwards. Acreage occupied by 'other cereals' declined significantly from 55.047 thousand hectares in 1974-75 to 16.022 thousand hectares during 2004-05. Similarly, the yield of 'other cereals' decreased from 0.606 t/ha to 0.549 t/ha between 1974-75 and 2004-05 while an upward growth was observed after 1989-90.

Total cereals experienced an increase in production from 965.069 thousand tonnes to 1321.129 thousand tonnes between 1974-75 and 2004-05. Area put to total cereals also increased from 768.414 thousand hectares to 829.311 thousand hectares between 1974-75 and 1989-90 but a decline to 781.249 thousand hectares was observed during 2004-05. The yield of total cereals grew up from 1.256 t/ha to 1.691 t/ha between 1974-75 and 2004-05. It can, thus, be inferred that during 1989-90 the increase in total cereals production resulted both from increase in the area and yield, but it was due to increase in the yield in 2004-05. Besides, pulses production decreased from 27.778 thousand tonnes to 9.136 thousand tonnes between 1974-75 and 2004-05 with a marginal increase from 1989-90 onwards. Acreage allotted to pulse production also came down from 69.875 thousand hectares in 1974-75 to 26.688 thousand hectares during 2004-05. The yield of pulses declined from 0.398 t/ha to 0.342 t/ha between 1974-75 and 2004-05 whereas a slight increase was evident after 1989-90. It implied that the decline in pulses production was due to decrease in both the area and yield by 1989-90 but the slight increase in pulse production could have resulted from rise in its yield in 2004-05. As regards the production of foodgrains, it increased from 999.717 thousand tonnes in 1974-75 to 1330.265 thousand tonnes in 2004-

05. Area under foodgrains grew up from 838.289 thousand hectares to 872.086 thousand hectares between 1974-75 and 1989-90 but it decreased to 806.533 thousand hectares in 2004-05. The yield of foodgrains increased from 1.193 t/ha in 1974-75 to 1.649 t/ha during 2004-05. It can be concluded that the increase in production of foodgrains in 1989-90 resulted from both increase in the area as well as yield, but it was due to rise in the yield in 2004-05.

In case of cash crops, potato production went up from 57.905 thousand tonnes to 154.762 thousand tonnes between 1974-75 and 2004-05. Acreage allocated to potato production increased from 14.915 thousand hectares to 15.703 thousand hectares between 1974-75 and 1989-90 while a decline to 14.818 thousand hectares was evident in 2004-05. The productivity of potato also increased from 3.882 t/ha in 1974-75 to 10.444 t/ha in 2004-05. It can, thus, be inferred that like foodgrains, the increase in potato production was due to increase in the area and yield in 1989-90 but it was boosted by increase in the yield in 2004-05. Furthermore, production of oilseeds experienced decline from 9.695 thousand tonnes in 1974-75 to 5.262 thousand tonnes during 1989-90 but an increase to 8.603 thousand tonnes was achieved in 2004-05. Area put to oilseeds production came down from 23.095 thousand hectares to 17.574 thousand hectares between 1974-75 and 2004-05 while the yield of oilseeds increased from 0.420 t/ha to 0.490 t/ha over the same period. Therefore, the increase in oilseeds production during 2004-05 could be attributed to increase in its yield.

In a nutshell, during the triennium ending 1974-75 to 2004-05 it was found that the production of rice, maize, wheat and potato increased whereas that of barley, 'other cereals', pulses and oilseeds went down in the state. While the area allotted to maize and wheat grew up, that under rice, barley, 'other cereals', pulses, potato and oilseeds decreased. As regards the yield, except 'other cereals' and pulses that witnessed a decline, it increased for rest of the crops and crop groups studied.

The changes in production, area and yield of major crops and crop groups at the district as well as state level were best explained in terms of their compound annual growth rates which have been discussed in detail under the next section. However, it is pertinent to know the highest and lowest levels in production, area and yield across districts in the state. It can be observed from the table 4.3.2 that the highest level of production of rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds

during the triennium ending 1974-75 was, respectively, recorded in Kangra (45.553 thousand tonnes), Kangra (77.632 thousand tonnes), Kangra (86.927 thousand tonnes), Shimla (10.614 thousand tonnes), Shimla (13.470 thousand tonnes), Kangra (215.644 thousand tonnes), Una (9.004 thousand tonnes), Kangra (219.744 thousand tonnes), Shimla (42.350 thousand tonnes) and Kangra (5.132 thousand tonnes) whereas the lowest most level of production of these crops and crop groups was, orderly, observed in Kinnaur (0.040 thousand tonnes), Kinnaur (0.510 thousand tonnes), Lahaul & Spiti (1.199 thousand tonnes), Una (0.019 thousand tonnes), Solan (0.006 thousand tonnes), Lahaul & Spiti (4.429 thousand tonnes), Kinnaur (0.044 thousand tonnes), Lahaul & Spit (5.458 thousand tonnes), Bilaspur (0.011 thousand tonnes) and Kinnaur (0.001 thousand tonnes). It can be concluded that during the triennium ending 1974-75 Kangra, Shimla and Una were the districts where the highest levels of production for the crops and crop groups under study were registered while Kinnaur, Lahaul & Spiti, Una, Solan and Bilaspur were the districts that recorded the lowest levels of production for the crops and crop groups studied.

The extent of the production of rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds was examined during the triennium ending 1989-90 and the highest level of production was, sequentially, observed in Kangra (34.873 thousand tonnes), Mandi (82.525 thousand tonnes), Kangra (125.694 thousand tonnes), Shimla (6.759 thousand tonnes), Shimla (4.498 thousand tonnes), Kangra (240.794 thousand tonnes), Kangra (1.642 thousand tonnes), Kangra (242.436 thousand tonnes), Shimla (42.005 thousand tonnes) and Kangra (3.300 thousand tonnes) while the lowest level of production of the above crops and crop groups was witnessed, respectively, in Kinnaur (0.024 thousand tonnes), Lahaul & Spiti (0.080 thousand tonnes), Lahaul & Spiti (0.597 thousand tonnes), Una (0.049 thousand tonnes), Solan (0.003 thousand tonnes), Lahaul & Spiti (1.888 thousand tonnes), Kinnaur (0.202 thousand tonnes), Lahaul & Spiti (2.554 thousand tonnes), Hamirpur (0.075 thousand tonnes) and Lahaul & Spiti (0.010 thousand tonnes). It suggested that Kangra and Shimla remained the districts where the highest level of production for most of the crops and crop groups under study was recorded during the triennium ending 1989-90 as well. However, the tribal districts of Lahaul & Spiti and Kinnaur also sustained its position as the districts registered the lowest level of production for most of the crops and crop groups studied during the same period of time.

Assessing the production of rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds during the triennium ending 2004-05 revealed that

the highest level of production of these crops and crop groups was experienced, orderly, in Kangra (46.340 thousand tonnes), Mandi (129.285 thousand tonnes), Kangra (144.693 thousand tonnes), Mandi (6.570 thousand tonnes), Shimla (5.049 thousand tonnes), Kangra (279.194 thousand tonnes), Mandi (2.042 thousand tonnes), Kangra (280.910 thousand tonnes), Shimla (47.196 thousand tonnes) and Kangra (4.160 thousand tonnes) whereas the lowest level of production of the above listed crops and crop groups was witnessed, respectively, in Kinnaur (0.038 thousand tonnes), Lahaul & Spiti (0.122 thousand tonnes), Lahaul & Spiti (0.153 thousand tonnes), Hamirpur (0.106 thousand tonnes), Hamirpur (0.002 thousand tonnes), Lahaul & Spiti (1.038 thousand tonnes), Hamirpur (0.042 thousand tonnes), Lahaul & Spiti (1.059 thousand tonnes), Hamirpur (0.066 thousand tonnes) and Kinnaur (0.0003 thousand tonnes). It implied that Kangra, Mandi and Shimla were the districts where the highest level of production of the crops and crop groups considered in the study was observed whereas Lahaul & Spiti, Hamirpur and Kinnaur were the districts that registered the lowest level of production of the crops and crop groups studied, during the triennium ending 2004-05.

In conclusion, it was observed that during all the three points of time considered i.e. 1974-75, 1989-90 and 2004-05, Kangra experienced the highest level of production of rice, wheat, total cereals, foodgrains and oilseeds. Thus, it could be considered as the major producer of these crops. Likewise, Shimla witnessed the highest level of production in case of other cereals and potato. The lowest level of production of wheat, total cereals and foodgrains was recorded in Lahaul & Spiti while rice production was the lowest in Kinnaur during all the three points of time studied.

An analysis of the extent of area under crops and crop groups under study demonstrated that during the triennium ending 1974-75 the largest area under rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds was, respectively, observed in Kangra (34.873 thousand hectares), Kangra (49.683 thousand hectares), Kangra (81.247 thousand hectares), Shimla (8.806 thousand hectares), Shimla (14.738 thousand hectares), Kangra (175.221 thousand hectares), Solan (11.481 thousand hectares), Kangra (186.406 thousand hectares), Shimla (8.783 thousand hectares) and Kangra (4.972 thousand hectares) while the lowest acreage under these crops and crop groups was witnessed in Kinnaur (0.037 thousand hectares), Kinnaur (0.293 thousand hectares), Lahaul & Spiti (0.482 thousand hectares), Una (0.016 thousand hectares), Una (0.016 thousand hectares), Lahaul & Spiti (1.900 thousand hectares), Kinnaur (0.277

thousand hectares), Lahaul & Spiti (1.906 thousand hectares), Bilaspur (0.017 thousand hectares) and Kinnaur (0.005 thousand hectares), in that order. It can be concluded that, Kangra, Shimla and Solan recorded the highest area under the crops and crops groups under consideration during the triennium ending 1974-75 whereas the lowest area under these crops and crop groups was experienced in Kinnaur, Lahaul & Spiti, Una and Solan.

The extent of acreage put to rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds production was examined during the triennium ending 1989-90. It was found that the highest area under these crops was registered, respectively, in Kangra (39.505 thousand hectares), Kangra (55.710 thousand hectares), Kangra (91.194 thousand hectares), Shimla (5.721 thousand hectares), Shimla (10.039 thousand hectares), Kangra (190.826 thousand hectares), Kangra (6.594 thousand hectares), Kangra (197.420 thousand hectares), Shimla (7.876 thousand hectares) and Kangra (3.069 thousand hectares) while the lowest area under these crops and crop groups was experienced, orderly, in Kinnaur (0.025 thousand hectares), Lahaul & Spiti (0.028 thousand hectares), Lahaul & Spiti (0.269 thousand hectares), Una (0.039 thousand hectares), Hamirpur (0.014 thousand hectares), Lahaul & Spiti (1.218 thousand hectares), Kinnaur (0.708 thousand hectares), Lahaul & Spiti (1.223 thousand hectares), Hamirpur (0.005 thousand hectares) and Lahaul & Spiti (0.008 thousand hectares). It showed that during the triennium ending 1989-90 the highest acreage under the crops and crop groups studied was recorded in Kangra and Shimla whereas the lowest area under these crops and crop groups was observed in Lahaul & Spiti, Kinnaur, Hamirpur and Una.

Analysis of the extent of area allocated to production of major crops and crop groups during the triennium ending 2004-05 revealed that the highest area under rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds was observed, sequentially, in Kangra (37.342 thousand hectares), Kangra (58.309 thousand hectares), Kangra (93.271 thousand hectares), Shimla (4.616 thousand hectares), Shimla (5.430 thousand hectares), Kangra (191.851 thousand hectares), Shimla (4.679 thousand hectares), Kangra (195.766 thousand hectares), Shimla (5.421 thousand hectares) and Kangra (4.086 thousand hectares) while the lowest acreage under these crops and crop groups was witnessed, respectively, in Kinnaur (0.033 thousand hectares), Lahaul & Spiti (0.060 thousand hectares), Lahaul & Spiti (0.102 thousand hectares), Hamirpur (0.082 thousand hectares), Hamirpur (0.004 thousand hectares), Lahaul & Spiti (0.789 thousand hectares), Hamirpur (0.141 thousand hectares), Lahaul & Spiti (1.347 thousand hectares),

Hamirpur (0.006 thousand hectares) and Kinnaur (0.0007 thousand hectares). It implied that Kangra and Shimla were the districts where the highest area under the crops and crop groups considered in the study was observed whereas Lahaul & Spiti, Hamirpur and Kinnaur experienced the lowest area under these crops and crop groups, during the triennium ending 2004-05. It is mentionable that the highest level of production went side by side with the highest acreage for most of the crops. Contrary to this, the lowest level of production traced a parallel trend with the lowest acreage for majority of the crops and crop groups studied. For instance, during all the three points of time i.e. 1974-75, 1989-90 and 2004-05, increase in production and area of rice, wheat, total cereals, foodgrains and oilseeds in Kangra; and that of other cereals and potato in Shimla. Decrease in production and area of rice in Kinnaur as well as wheat, total cereals and foodgrains in Lahaul & Spiti.

The growth of productivity is of crucial importance for fostering overall growth in agriculture because possibility of increasing production via extension of area under plough is severely limited and can only be made possible by incurring colossal costs in the hilly terrains. Thus, increase in production with the same level of inputs can only happen through improving productivity of crops. To examine the variations in productivity levels in the state, an attempt was made to study the highest and lowest levels of yield of major crops and crops groups considered among the districts. It can be seen from the table 4.3.2 that during the triennium ending 1974-75 the highest levels of the yield of rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds were observed, respectively, in Kullu (1.303 t/ha), Kullu (2.131 t/ha), Lahaul & Spiti (2.488 t/ha), Lahaul & Spiti (2.974 t/ha), Shimla (0.914 t/ha), Lahaul & Spiti (2.594 t/ha), Una (0.823 t/ha), Lahaul & Spiti (2.864 t/ha), Lahaul & Spiti (12.579 t/ha) and Kangra (1.032 t/ha) whereas the lowest level of productivity was obtained, in order, by Sirmaur (0.863 t/ha), Una (1.498 t/ha), Chamba (0.819 t/ha), Solan (1.002 t/ha), Solan (0.020 t/ha), Kinnaur (0.737 t/ha), Kinnaur (0.160 t/ha), Kinnaur (0.723 t/ha), Bilaspur (0.667 t/ha) and Hamirpur (0.176 t/ha). This implied that during the triennium ending 1974-75 Lahaul & Spiti and Kullu were among the districts registering the highest levels of yield for large number crops than others whereas Kinnaur and Solan were the districts that witnessed the lowest levels of yield for more crops. From the highest and lowest levels of productivity one can comprehend the range within which the yield of the respective crops and crop groups falls. Nevertheless, the top most levels of productivity of rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds in the triennium ending

1989-90 were experienced, respectively, in Chamba (1.352 t/ha), Kinnaur (3.557 t/ha), Lahaul & Spiti (2.217 t/ha), Kullu (1.817 t/ha), Kangra (0.771 t/ha), Chamba (1.804 t/ha), Kinnaur (0.285 t/ha), Lahaul & Spiti (2.088 t/ha), Lahaul & Spiti (20.582 t/ha) and Lahaul & Spiti (1.250 t/ha) while the lower most level of yield was registered in that sequence by Bilaspur (0.723 t/ha), Bilaspur (1.144 t/ha), Kinnaur (0.693 t/ha), Solan (0.675 t/ha), Solan (0.022 t/ha), Kinnaur (0.737 t/ha), Solan (0.063 t/ha), Kinnaur (0.692 t/ha), Kullu (5.262 t/ha) and Solan (0.094 t/ha). Hence, it can be inferred that Lahaul & Spiti maintained its position of highest yield for large number of crops among the districts but Kinnaur and Chamba excelled Kullu. In relation to the lower most levels of yield, Solan went beyond Kinnaur by recording the lowest yield for several crops. However, examination of the highest ranked and the lowest ranked yield of rice, maize, wheat, barley, other cereals, total cereals, pulses, foodgrains, potato and oilseeds for the triennium ending 2004-05 revealed that the highest level of productivity was witnessed, respectively, in Solan (1.755 t/ha), Mandi (2.734 t/ha), Una (1.802 t/ha), Kinnaur (2.038 t/ha), Shimla (0.930 t/ha), Una (1.896 t/ha), Kinnaur (0.918 t/ha), Una (1.881 t/ha), Lahaul & Spiti (14.625 t/ha) and Lahaul & Spiti (1.026 t/ha) whereas the lowest level of the yield was experienced, sequentially, in Hamirpur (0.893 t/ha), Kangra (1.454 t/ha), Shimla (1.133 t/ha), Solan (0.773 t/ha), Kangra (0.052 t/ha), Kinnaur (1.296 t/ha), Kullu (0.157 t/ha), Lahaul & Spiti (0.786 t/ha), Kullu (7.600 t/ha) and Chamba (0.258 t/ha). It is obvious that Una replaced Lahaul & Spiti by recording the highest level of productivity for more of the crops, followed by Kinnaur and Lahaul & Spiti. Anyhow, Kangra and Kullu demonstrated the lowest yield for several crops. Broadly speaking, the highest level of yield for majority of the crops and crop groups was witnessed in Lahaul & Spit and Kullu; Lahaul & Spiti, Kinnaur, Chamba and Kullu; and Una, Kinnaur and Lahaul & Spiti during the triennium endings 1974-75, 1989-90 and 2004-05, in that order. Contrarily, the lowest level of yield for most of the crops and crop groups was observed in Kinnaur and Solan; Solan, Kinnaur and Bilaspur; and Kangra and Kullu during the same points of time, respectively.

Table 4.3.2 Trends in Production, Area and Yield of Major Crops & Crop Groups in Himachal Pradesh, 1972-73 to 2004-05.

Production (P) in '000 tonnes, Area (A) in '000 hectares, Yield (Y) in tonnes/hectare (t/ha)

Triennium Ending (TE)	Features	Crops & Crop Groups									
		Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
		Himachal Pradesh									
1974-75	P	101.675	452.261	330.228	48.783	32.121	965.069	27.778	999.717	57.905	9.695
	A	96.058	261.976	315.740	41.594	53.047	768.414	69.875	838.289	14.915	23.095
	Y	1.058	1.726	1.046	1.173	0.606	1.256	0.398	1.193	3.882	0.420
1989-90	P	86.825	522.420	469.615	35.007	8.795	1122.663	8.089	1130.752	115.964	5.262
	A	91.206	309.579	373.043	35.007	25.741	829.311	42.775	872.086	15.703	21.600
	Y	0.952	1.688	1.259	1.000	0.342	1.354	0.189	1.297	7.385	0.244
2004-05	P	105.135	616.399	559.980	30.822	8.792	1321.129	9.136	1330.265	154.762	8.603
	A	81.379	296.372	363.433	24.044	16.022	781.249	26.688	806.533	14.818	17.574
	Y	1.292	2.080	1.541	1.282	0.549	1.691	0.342	1.649	10.444	0.490
		Bilaspur									
1974-75	P	3.276	31.732	21.671	0.288	-	61.691	3.704	65.395	0.011	0.333
	A	3.710	21.118	18.981	0.258	-	44.076	8.187	52.263	0.017	0.828
	Y	0.883	1.503	1.142	1.118	-	1.400	0.452	1.251	0.667	0.403
1989-90	P	2.307	29.679	31.552	0.530	-	64.068	0.516	64.584	0.237	0.193
	A	3.189	25.948	26.437	0.464	-	56.037	2.301	58.338	0.022	0.985
	Y	0.723	1.144	1.193	1.142	-	1.143	0.224	1.107	10.627	0.196
2004-05	P	1.791	47.518	45.056	0.261	0.004	94.630	0.236	94.865	0.181	0.227
	A	1.557	25.860	27.639	0.208	0.008	55.272	0.482	55.755	0.019	0.475
	Y	1.150	1.838	1.630	1.255	0.520	1.712	0.489	1.701	9.714	0.478

Contd... *Production (P) in '000 tonnes, Area (A) in '000 hectares, Yield (Y) in tonnes/hectare (t/ha)*

Triennium Ending (TE)	Features	Crops & Crop Groups									
		Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
		Chamba									
1974-75	P	3.526	50.658	13.255	6.269	1.276	74.985	1.052	76.037	0.611	0.700
	A	3.060	24.981	16.190	6.241	3.845	54.317	3.333	57.650	0.488	2.563
	Y	1.152	2.028	0.819	1.005	0.332	1.380	0.316	1.319	1.252	0.273
1989-90	P	3.962	67.720	23.641	5.256	0.298	100.877	0.466	101.344	3.119	0.286
	A	2.931	27.770	18.722	4.175	2.334	55.933	3.359	59.291	0.477	2.646
	Y	1.352	2.439	1.263	1.259	0.128	1.804	0.139	1.709	6.544	0.108
2004-05	P	4.562	71.728	25.310	3.643	0.273	105.516	0.890	106.406	7.397	0.716
	A	2.755	28.347	20.105	3.451	1.605	56.263	3.323	59.586	0.681	2.779
	Y	1.656	2.530	1.259	1.056	0.170	1.875	0.268	1.786	10.856	0.258
		Hamirpur									
1974-75	P	5.241	40.901	24.288	0.242	4.589	75.262	1.664	76.926	0.026	0.066
	A	5.614	26.310	22.430	0.215	10.892	65.461	5.226	70.687	0.018	0.376
	Y	0.934	1.555	1.083	1.127	0.421	1.150	0.318	1.088	1.444	0.176
1989-90	P	3.177	45.791	31.101	0.202	0.004	80.276	0.196	80.452	0.075	0.038
	A	3.637	32.049	36.026	0.176	0.014	71.902	1.406	73.308	0.005	0.206
	Y	0.873	1.429	0.863	1.152	0.293	1.116	0.139	1.097	14.000	0.184
2004-05	P	2.732	56.883	52.606	0.106	0.002	112.329	0.042	112.371	0.066	0.082
	A	3.058	31.526	34.465	0.082	0.004	69.136	0.141	69.276	0.006	0.126
	Y	0.893	1.804	1.526	1.291	0.500	1.625	0.299	1.622	11.000	0.651

Contd... *Production (P) in '000 tonnes, Area (A) in '000 hectares, Yield (Y) in tonnes/hectare (t/ha)*

Triennium Ending (TE)	Features	Crops & Crop Groups									
		Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
		Kangra									
1974-75	P	45.553	77.632	86.927	5.211	0.321	215.644	4.250	219.744	12.327	5.132
	A	38.619	49.683	81.247	4.890	5.671	175.221	11.185	186.406	1.035	4.972
	Y	1.180	1.563	1.070	1.066	0.057	1.231	0.380	1.179	11.910	1.032
1989-90	P	34.873	76.511	125.694	3.715	3.405	240.794	1.642	242.436	11.252	3.300
	A	39.505	55.710	91.194	3.521	4.417	190.826	6.594	197.420	0.977	3.069
	Y	0.883	1.373	1.378	1.055	0.771	1.262	0.249	1.228	11.517	1.075
2004-05	P	46.340	84.805	144.693	3.203	0.152	279.194	1.716	280.910	18.754	4.160
	A	37.342	58.309	93.271	2.485	2.929	191.851	3.914	195.766	1.581	4.086
	Y	1.241	1.454	1.551	1.289	0.052	1.455	0.438	1.435	11.865	1.018
		Kinnaur									
1974-75	P	0.040	0.510	1.929	3.793	1.446	7.718	0.044	7.762	1.169	0.001
	A	0.037	0.293	1.726	2.714	5.696	10.466	0.277	10.743	0.403	0.005
	Y	1.081	1.741	1.118	1.398	0.254	0.737	0.160	0.723	2.901	0.200
1989-90	P	0.024	1.846	0.610	1.240	1.063	4.783	0.202	4.985	3.666	0.010
	A	0.025	0.519	0.881	1.686	3.382	6.493	0.708	7.201	0.326	0.030
	Y	0.960	3.557	0.693	0.735	0.314	0.737	0.285	0.692	11.245	0.333
2004-05	P	0.038	0.718	0.615	2.382	1.334	5.086	1.003	6.089	1.637	0.0003
	A	0.033	0.343	0.352	1.169	2.025	3.923	1.092	5.015	0.207	0.0007
	Y	1.152	2.093	1.747	2.038	0.659	1.296	0.918	1.214	7.908	0.4286

Contd... *Production (P) in '000 tonnes, Area (A) in '000 hectares, Yield (Y) in tonnes/hectare (t/ha)*

Triennium Ending (TE)	Features	Crops & Crop Groups									
		Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
		Kullu									
1974-75	P	4.686	26.029	17.543	7.160	2.259	57.677	1.000	37.677	5.187	0.198
	A	3.597	12.215	16.823	6.397	5.849	44.882	3.010	47.892	1.029	0.496
	Y	1.303	2.131	1.043	1.119	0.386	1.285	0.332	0.787	5.041	0.399
1989-90	P	2.823	32.903	34.691	5.666	0.947	77.029	0.614	77.643	5.730	0.328
	A	2.633	16.406	20.084	3.118	3.543	45.785	3.632	49.416	1.089	0.631
	Y	1.072	2.005	1.727	1.817	0.267	1.682	0.169	1.571	5.262	0.520
2004-05	P	2.464	34.993	38.678	4.585	0.358	81.079	0.464	81.543	10.359	0.249
	A	1.608	16.919	23.247	3.541	1.115	46.429	2.954	49.383	1.363	0.760
	Y	1.532	2.068	1.664	1.295	0.321	1.746	0.157	1.651	7.600	0.328
		Lahaul & Spiti									
1974-75	P	-	-	1.199	3.230	0.500	4.929	-	5.458	5.082	0.014
	A	-	-	0.482	1.086	1.415	1.900	-	1.906	0.404	0.022
	Y	-	-	2.488	2.974	0.353	2.594	-	2.864	12.579	0.636
1989-90	P	-	0.080	0.597	0.945	0.266	1.888	-	2.554	23.710	0.010
	A	-	0.028	0.269	0.819	0.921	1.218	-	1.223	1.152	0.008
	Y	-	2.857	2.217	1.154	0.289	1.550	-	2.088	20.582	1.250
2004-05	P	-	0.122	0.153	0.714	0.048	1.038	-	1.059	11.422	0.039
	A	-	0.060	0.102	0.534	0.627	0.789	-	1.347	0.781	0.038
	Y	-	2.033	1.500	1.337	0.077	1.316	-	0.786	14.625	1.026

Contd... *Production (P) in '000 tonnes, Area (A) in '000 hectares, Yield (Y) in tonnes/hectare (t/ha)*

Triennium Ending (TE)	Features	Crops & Crop Groups									
		Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
		Mandi									
1974-75	P	23.646	61.414	56.543	6.137	7.421	155.160	4.440	159.600	4.686	0.484
	A	24.522	36.256	54.251	5.487	8.541	129.057	5.852	134.908	1.750	1.004
	Y	0.964	1.694	1.042	1.118	0.869	1.202	0.759	1.183	2.678	0.482
1989-90	P	22.487	82.525	78.257	5.716	1.104	190.090	1.132	191.222	11.293	0.177
	A	24.079	45.559	66.028	4.683	4.171	144.519	6.473	150.992	2.051	1.176
	Y	0.934	1.811	1.185	1.221	0.265	1.315	0.175	1.266	5.506	0.151
2004-05	P	25.572	129.285	99.302	6.570	1.342	262.072	2.042	264.114	33.886	0.810
	A	20.276	47.289	66.455	3.883	2.431	140.333	3.139	143.472	2.430	1.165
	Y	1.261	2.734	1.494	1.692	0.552	1.868	0.651	1.841	13.945	0.695
		Shimla									
1974-75	P	5.561	35.000	36.151	10.614	13.470	100.795	1.354	102.383	42.350	0.052
	A	5.485	20.788	32.196	8.806	14.738	82.012	4.775	86.788	8.783	0.294
	Y	1.014	1.684	1.123	1.205	0.914	1.229	0.284	1.180	4.822	0.178
1989-90	P	4.501	40.421	42.432	6.759	4.498	98.610	0.720	99.331	42.005	0.060
	A	4.578	22.274	30.116	5.721	10.039	72.729	4.990	77.719	7.876	0.532
	Y	0.983	1.815	1.409	1.181	0.448	1.356	0.144	1.278	5.333	0.113
2004-05	P	2.322	32.476	17.787	5.032	5.049	62.666	1.423	64.089	47.196	0.265
	A	2.443	14.127	15.699	4.616	5.430	42.315	4.679	46.994	5.421	0.633
	Y	0.950	2.299	1.133	1.090	0.930	1.481	0.304	1.364	8.706	0.419

Contd... *Production (P) in '000 tonnes, Area (A) in '000 hectares, Yield (Y) in tonnes/hectare (t/ha)*

Triennium Ending (TE)	Features	Crops & Crop Groups									
		Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
		Sirmaur									
1974-75	P	4.281	45.635	30.911	3.672	1.015	85.513	2.413	87.927	1.173	0.398
	A	4.961	23.786	27.328	3.577	2.055	61.707	5.418	67.125	0.686	1.166
	Y	0.863	1.919	1.131	1.027	0.494	1.386	0.445	1.310	1.710	0.341
1989-90	P	6.321	58.119	37.977	2.731	0.552	105.700	0.999	106.699	14.001	0.359
	A	5.001	25.949	28.765	2.874	1.273	63.861	3.976	67.837	1.311	1.273
	Y	1.264	2.240	1.320	0.950	0.434	1.655	0.251	1.573	10.680	0.282
2004-05	P	7.296	55.978	37.881	2.931	0.218	104.304	0.489	104.793	15.194	0.587
	A	5.387	23.108	25.645	2.527	0.524	57.191	2.544	59.735	1.507	1.361
	Y	1.354	2.422	1.477	1.160	0.416	1.824	0.192	1.754	10.082	0.431
		Solan									
1974-75	P	3.691	39.825	18.604	1.913	0.006	64.038	5.409	69.448	1.018	1.961
	A	4.119	23.182	20.866	1.909	0.294	50.369	11.481	61.850	0.197	2.504
	Y	0.896	1.718	0.892	1.002	0.020	1.271	0.471	1.123	5.168	0.783
1989-90	P	4.386	49.023	27.880	1.215	0.003	82.507	0.396	82.903	0.916	0.170
	A	3.829	25.515	24.005	1.801	0.137	55.288	6.239	61.526	0.123	1.812
	Y	1.145	1.921	1.161	0.675	0.022	1.492	0.063	1.347	7.447	0.094
2004-05	P	7.881	41.843	38.157	1.395	0.011	89.287	0.511	89.797	0.981	0.503
	A	4.491	23.043	23.294	1.804	0.020	52.652	2.291	54.943	0.093	1.471
	Y	1.755	1.816	1.638	0.773	0.550	1.696	0.223	1.634	10.548	0.342

Contd... ***Production (P) in '000 tonnes, Area (A) in '000 hectares, Yield (Y) in tonnes/hectare (t/ha)***

Triennium Ending (TE)	Features	Crops & Crop Groups									
		Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
		Una									
1974-75	P	2.174	34.993	24.542	0.019	0.007	61.735	9.004	70.739	0.694	0.354
	A	2.333	23.362	23.220	0.016	0.016	48.947	10.934	59.881	0.105	1.061
	Y	0.932	1.498	1.057	1.188	0.438	1.261	0.823	1.181	6.610	0.334
1989-90	P	1.965	38.845	35.182	0.049	-	76.041	0.580	76.601	1.799	0.335
	A	1.797	31.702	30.577	0.039	-	64.116	2.543	66.659	0.293	2.128
	Y	1.093	1.225	1.151	1.256	-	1.186	0.228	1.149	6.140	0.157
2004-05	P	4.137	60.050	59.741	-	-	123.929	0.297	124.226	7.687	0.982
	A	2.428	29.773	33.159	-	-	65.361	0.668	66.029	0.738	1.646
	Y	1.704	2.017	1.802	-	-	1.896	0.445	1.881	10.416	0.597

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

4.3.3. Compound Annual Growth Rates of Production, Area and Yield

Since, the triennium endings only tell us what happened to production, area and yield between two or more points of time but are unable to delineate the complete trend by a single figure, thus compound annual growth rates of production, area and yield were calculated so as to understand the growth path traced by production, area and yield in the districts and the state as a whole. Table 4.3.3 displays compound annual growth rates of production of major crops and crop groups computed for the period from 1972-73 to 2004-05 (overall period) which was further divided into two sub-periods i.e. first period (P_1) and second period (P_2), 1972-73 to 1987-88 and 1988-89 to 2004-05, respectively. Growth analysis of production of various crops and crop groups for the state revealed that no significant change was observed in rice production during all the three periods. Maize and wheat, the two most important cereal crops of the state, registered a significant growth of 1.50 per cent and 1.88 per cent per annum (% p.a.), respectively, during the overall study period. The production of barley exhibited negative growth rates, which were significant, during all the three periods.

The 'other cereals' and pulses on the other hand witnessed high negative growth rates of 4.65 per cent and 3.53 per cent per annum, which were significant. The fall in the pulse production in the state was very high during the first period (9.93% p.a.). As a result of these production trends, foodgrains production in the state grew annually at the rate of 1.26 per cent during 1972-73 to 2004-05. As regards the commercial crops, potato production registered very high growth (4.27% p.a.) in the state during the overall period. On the contrary, oilseeds production declined at the rate of 7.06 per cent per annum during the first period, and increased at the rate of 2.71 per cent per annum during the second period. In short, the production of maize, wheat, total cereals, foodgrains and potato witnessed significant increase while that of barley, other cereals and pulses declined significantly in the state during the study period.

The growth analysis of the production of various crops and crop groups at the state level provided only an aggregate view. Therefore, the production trends of various crops were examined at the disaggregated level of districts as well. The analysis of production trends for major crops and crop groups at district levels depicted that apart from Hamirpur and Una where rice production recorded decline with growth rates of 4.41 per cent and 3.71 per cent per annum, respectively, no conspicuous ups or downs were observed in rest

of the districts during the first period. The scenario changed in the second period when Una, Kinnaur, Solan, Kangra and Mandi recorded an increase in rice production with annual growth rates ranging from 1.47 per cent in Mandi to 6.55 per cent in Una whereas it came down in Kullu and Shimla at the rate of 2.31 per cent and 3.60 per cent per annum, in that order. However, the overall period presented a declining trend of rice production in Shimla, Bilaspur, Hamirpur and Kullu with yearly growth rates varying between 1.69 per cent in Kullu and 2.76 per cent in Shimla while Sirmaur, Solan and Una registered increasing growth rates of 1.94 per cent, 2.12 per cent and 3.68 per cent per annum, respectively.

Whilst investigating growth performance of maize production, it was seen that over the first period there was no remarkable change in most of the districts, except in Kinnaur where it increased at the rate of 8.25 per cent per annum. The second period exhibited a different view, with Bilaspur, Mandi and Una registering increasing annual growth rates of 2.68 per cent, 2.52 per cent and 2.40 per cent, respectively, while Shimla witnessed a decline at the rate of 2.17 per cent per annum. The analysis of maize production for the overall period demonstrated that it grew up in majority of the districts (ten) recording per annum growth rates ranging from 0.77 per cent in Kangra to 8.39 per cent in Lahaul & Spiti. The trend analysis of wheat production revealed that it went up in Chamba (2.95% p.a.) and Kullu (4.39% p.a.) while it declined in the tribal districts of Kinnaur (6.83% p.a.) and Lahaul & Spiti (13.60% p.a.) during the first period. The second period showed that wheat production increased only in Una (2.41% p.a.) while it declined in Lahaul & Spiti (7.58% p.a.) and Shimla (6.77% p.a.). The increases or decreases were, however, not significant in rest of the districts. Investigation of wheat production for the overall period depicted that it grew up in most of the districts (eight) registering growth rates varying from 1.88 per cent per annum in Mandi to 3.45 per cent per annum in Una. But, it declined in Kinnaur (3.67% p.a.), Lahaul & Spiti (5.83% p.a.) and Shimla (2.17% p.a.). It was not considerable, for one or another reason, in the remaining districts.

As far as growth in barley production is concerned, it was observed that Kangra, Kullu and Shimla recorded a downturn with annual growth rates of 1.43 per cent, 1.97 per cent and 2.89 per cent, in that order, whereas no conspicuous increases or declines were evident in rest of the districts during the overall period. Assessment of barley production during the first period depicted that, among others, Bilaspur registered an increase in barley production (4.86% p.a.) while a downward growth was evident in Kinnaur (6.87%

p.a.), Kullu (2.12% p.a.) and Lahaul & Spiti (20.44% p.a.). No remarkable change was observed in the remaining districts. During the second period, barley production came down in Bilaspur (7.50% p.a.), Hamirpur (6.43% p.a.) and Sirmaur (2.39% p.a.) while it went up in Kinnaur (2.44% p.a.). However, the ups and downs were not significant in rest of the districts.

In addition, 'other cereals' production declined considerably in half of the districts (six) registering growth rates ranging from 6.11 per cent per annum in Sirmaur to 32.85 per cent per annum in Hamirpur, but the decrease was not significant in Kangra and Kinnaur during the first period. Second period traced the trend of 'other cereals' production the other way, when apart from Hamirpur and Kullu where pronounced declining growth was recorded at the rate of 5.99 per cent and 8.22 per cent per annum, respectively, majority of the districts experienced no considerable deceleration. During the overall period, most of the districts (seven) registered conspicuous downturn in production of 'other cereals' with annual growth rates ranging from 1.85 per cent in Kinnaur to 13.12 per cent in Hamirpur.

Besides, while analyzing the growth path of total cereals production for the overall period, it was found that it increased in majority of the districts recording growth rates in the range of 1.04 per cent per annum in Sirmaur to 2.64 per cent per annum in Una whereas it declined in Shimla (1.45% p.a.), Kinnaur (1.56% p.a.) and Lahaul & Spiti (4.10% p.a.). Over the first period, total cereals production grew up significantly in Kullu (1.94% p.a.) but went down in Kinnaur (2.68% p.a.) and Lahaul & Spiti (17.15% p.a.). The increases or decreases were, anyhow, not considerable in rest of the districts. Furthermore, growth analysis put forward that during the second period there was significant increase in total cereals production in Mandi (1.62% p.a.) and Una (2.48% p.a.) while a decline was observed in Shimla (3.70% p.a.). There were, however, no conspicuous ups or downs in rest of the districts. Foodgrains production traced almost the same trends over the three periods as that of total cereals.

In relation to the assessment of the growth behaviour of pulses production it was evident that except Kinnaur where it went up (13.11% p.a.), majority of the districts secured a downward growth at the annual rates varying from 5.65 per cent in Mandi to 20.02 per cent in Una, during the first period. Kinnaur kept its growing trend by registering an increasing growth (13.91% p.a.) while Bilaspur, Hamirpur, Lahaul & Spiti, Sirmaur and Una displayed considerable decrease with yearly growth rates varying from 5.83 per cent in Sirmaur to 21.52 per cent in Lahaul & Spiti during the second period. However, for the overall period results showed that Kinnaur sustained its increasing trend by securing

growth rate of 11.96 per cent per annum whereas significant decline was seen in most of the districts with annual growth rates ranging from 1.84 per cent in Mandi to 12.31 per cent in Hamirpur.

The growth analysis of potato production demonstrated that only Bilaspur registered a considerable increase (14.76% p.a.) whereas Chamba, Hamirpur, Kullu, Shimla and Solan experienced decelerating growth at the rates varying from 5.11 per cent per annum in Solan to 14.87 per cent per annum in Kullu over the first period. The scenario changed during the second period such that Chamba, Kangra, Mandi and Una recorded increasing annual growth rates ranging from 5.12 per cent in Chamba to 11.06 per cent in Una while a downward trend was observed in Bilaspur (4.83% p.a.), Kinnaur (5.65% p.a.) and Lahaul & Spiti (5.98% p.a.). However, the growth rates were not significant for rest of the districts. During the overall study period potato production went up in all the districts but the rise was, for one reason or the other, not significant for some of them. That is to say, most of the districts registered considerable yearly growth at the rates ranging between 3.75 per cent in Lahaul & Spiti and 12.45 per cent in Chamba.

The growth path of oilseeds production revealed that it decreased in all the districts, however, the decline was not significant in some of the districts (five), and those districts recorded considerable decrease secured growth rates in the range of 5.47 per cent per annum in Hamirpur to 14 per cent per annum in Solan, during the first period of study. A considerable increase in oilseeds production was observed during the second period in Chamba (5.68% p.a.), Mandi (10.36% p.a.) and Una (6.98% p.a.) whereas the ups and down in rest of the districts were not significant. Anyhow, the overall trend delineated that Kullu, Mandi, Shimla and Una displayed pronounced growth in oilseeds production at the rate of 3.75 per cent, 4.07 per cent, 8.77 per cent and 5.01 per cent per annum, respectively. Apart from Solan which experienced decreasing trend (3.30% p.a.), no considerable upwards or downwards trends were recorded in the remaining districts as regards the oilseeds production.

In conclusion, the analysis of growth rates of production at the district level revealed the production of maize, wheat, total cereals, foodgrains and potato recorded significant increasing growth rates in most of the districts while 'other cereals' and pulses production witnessed considerable decline in most of the districts during the overall period. The production of rice depicted considerable increase in Sirmaur, Solan and Una whereas that of oilseeds grew up significantly in Kullu, Mandi, Shimla and Una, but barley production declined substantially in Kangra, Kullu and Shimla during the study period.

Table 4.3.3 District-wise Compound Annual Growth Rates of Production of Major Crops in Himachal Pradesh, 1972-73 to 2004-05.

(per cent per annum)

Period[27]	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Himachal Pradesh									
P_1	-3.25$^{n.s}$ (1.94)	0.95$^{n.s}$ (0.64)	1.46$^{n.s}$ (1.17)	-2.90** (0.92)	-5.14$^{n.s}$ (2.99)	0.65$^{n.s}$ (0.54)	-9.93** (1.66)	0.42$^{n.s}$ (0.53)	-2.47$^{n.s}$ (1.77)	-7.06** (0.78)
P_2	1.08$^{n.s}$ (0.55)	0.68$^{n.s}$ (0.60)	-0.25$^{n.s}$ (1.16)	-1.56* (0.69)	-1.73$^{n.s}$ (1.31)	0.34$^{n.s}$ (0.53)	-0.87$^{n.s}$ (0.96)	0.33$^{n.s}$ (0.53)	0.79$^{n.s}$ (1.03)	2.71* (0.95)
O	0.48$^{n.s}$ (0.54)	1.50** (0.23)	1.88** (0.43)	-1.50** (0.29)	-4.65** (0.78)	1.35** (0.20)	-3.53** (0.65)	1.26** (0.21)	4.27** (0.75)	0.40$^{n.s}$ (0.59)
	Bilaspur									
P_1	-3.62$^{n.s}$ (1.88)	1.95$^{n.s}$ (1.70)	-0.003$^{n.s}$ (2.488)	4.86* (1.96)	-	0.50$^{n.s}$ (1.38)	-19.81** (3.24)	0.002$^{n.s}$ (1.346)	14.76** (4.80)	-7.31$^{n.s}$ (4.00)
P_2	-3.59$^{n.s}$ (1.79)	2.68* (1.15)	0.09$^{n.s}$ (2.52)	-7.50** (2.49)	-	1.52$^{n.s}$ (0.92)	-10.09** (1.45)	1.46$^{n.s}$ (0.91)	-4.83* (1.81)	-3.67$^{n.s}$ (2.15)
O	-2.29** (0.65)	2.17** (0.49)	2.48* (0.92)	-0.28$^{n.s}$ (1.00)	-	2.01** (0.41)	-8.79** (1.21)	1.81** (0.41)	11.22** (1.71)	-0.80$^{n.s}$ (1.24)
	Chamba									
P_1	0.94$^{n.s}$ (1.15)	-0.31$^{n.s}$ (0.95)	2.95** (1.14)	-0.65$^{n.s}$ (2.64)	-10.12** (2.53)	0.31$^{n.s}$ (0.68)	-8.47** (1.99)	0.23$^{n.s}$ (0.68)	-9.04** (2.33)	-9.53** (2.27)
P_2	0.16$^{n.s}$ (1.08)	-0.34$^{n.s}$ (0.72)	-0.57$^{n.s}$ (1.19)	-1.93$^{n.s}$ (1.11)	-1.10$^{n.s}$ (1.98)	-0.40$^{n.s}$ (0.67)	3.97$^{n.s}$ (2.43)	-0.38$^{n.s}$ (0.66)	5.12** (1.26)	5.68* (2.08)
O	0.66$^{n.s}$ (0.38)	1.78** (0.36)	2.31** (0.46)	-0.99$^{n.s}$ (0.66)	-3.12** (0.93)	1.63** (0.30)	0.43$^{n.s}$ (1.00)	1.61** (0.30)	12.45** (1.87)	1.03$^{n.s}$ (1.08)

[27] P_1 = First Period (1972-73 to 1987-88), P_2 = Second Period (1988-89 to 2004-05) and O = Overall Period (1972-73 to 2004-05).

Contd... *per cent per annum*

Period	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Hamirpur									
P_1	-4.41* (2.03)	0.48$^{n.s}$ (1.12)	-0.60$^{n.s}$ (2.02)	0.47$^{n.s}$ (4.10)	-32.85** (6.74)	-0.39$^{n.s}$ (1.04)	-18.61** (3.78)	-0.65$^{n.s}$ (1.04)	-14.31** (2.88)	-5.47** (2.17)
P_2	-1.38$^{n.s}$ (0.87)	0.51$^{n.s}$ (0.99)	-0.12$^{n.s}$ (2.44)	-6.43** (1.13)	-5.99* (2.60)	0.47$^{n.s}$ (0.88)	-13.13** (2.54)	0.46$^{n.s}$ (0.88)	1.51$^{n.s}$ (3.34)	5.27$^{n.s}$ (3.83)
O	-1.90** (0.55)	1.39** (0.37)	2.13* (0.84)	-0.99$^{n.s}$ (1.05)	-13.12** (2.54)	1.50** (0.36)	-12.31** (1.21)	1.37** (0.37)	8.41** (2.18)	2.42$^{n.s}$ (1.22)
	Kangra									
P_1	-1.13$^{n.s}$ (1.09)	1.11$^{n.s}$ (0.85)	1.95$^{n.s}$ (1.21)	-2.15$^{n.s}$ (1.22)	[28]-10.35$^{n.s}$ (5.56)	0.97$^{n.s}$ (0.64)	-6.17** (1.42)	0.88$^{n.s}$ (0.63)	-4.63$^{n.s}$ (2.29)	-6.64** (0.77)
P_2	1.88* (0.78)	0.60$^{n.s}$ (0.80)	-0.60$^{n.s}$ (1.33)	-2.73$^{n.s}$ (1.40)	[29]-7.22$^{n.s}$ (7.92)	0.16$^{n.s}$ (0.60)	0.55$^{n.s}$ (1.12)	0.16$^{n.s}$ (0.60)	6.60* (2.74)	1.65$^{n.s}$ (1.24)
O	0.36$^{n.s}$ (0.35)	0.77* (0.28)	1.98** (0.48)	-1.43** (0.47)	-	1.20** (0.23)	-2.64** (0.53)	1.15** (0.22)	1.67$^{n.s}$ (1.01)	-0.45$^{n.s}$ (0.56)
	Kinnaur									
P_1	-2.87$^{n.s}$ (1.99)	8.25** (1.79)	-6.83** (1.45)	-6.87** (1.88)	-2.09$^{n.s}$ (2.09)	-2.68* (1.08)	13.11** (1.55)	-2.43* (1.06)	2.63$^{n.s}$ (1.29)	-
P_2	4.13** (1.16)	-1.92$^{n.s}$ (0.93)	-0.24$^{n.s}$ (1.12)	2.44* (1.07)	-1.77$^{n.s}$ (1.22)	0.21$^{n.s}$ (0.70)	13.91** (3.20)	1.57** (0.75)	-5.65** (1.72)	-1.69$^{n.s}$ (7.93)
O	0.14$^{n.s}$ (0.63)	1.20$^{n.s}$ (0.65)	-3.67** (0.53)	-1.09$^{n.s}$ (0.68)	-1.85** (0.57)	-1.56** (0.33)	11.96** (0.89)	-0.79* (0.36)	0.91$^{n.s}$ (0.74)	-

[28] It is computed for the period 1972-73 to 1986-87.
[29] It is computed for the period 1990-91 to 2004-05.

Contd... *per cent per annum*

Period	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Kullu									
P_1	-2.33$^{n.s}$ (2.47)	2.12$^{n.s}$ (1.15)	4.39** (1.17)	-2.12* (0.86)	-7.45** (2.12)	1.94* (0.73)	-7.70** (1.74)	7.12* (2.92)	-14.87** (3.02)	-11.54** (1.57)
P_2	-2.31* (0.88)	0.81$^{n.s}$ (1.57)	0.09$^{n.s}$ (0.66)	-1.31$^{n.s}$ (1.41)	-8.22* (2.87)	0.26$^{n.s}$ (0.82)	-4.20$^{n.s}$ (2.05)	0.22$^{n.s}$ (0.82)	2.89$^{n.s}$ (1.75)	5.01$^{n.s}$ (4.32)
O	-1.69** (0.61)	1.46** (0.48)	2.88** (0.38)	-1.97** (0.41)	-8.90** (0.88)	1.43** (0.28)	-2.19** (0.80)	2.64** (0.74)	4.96** (1.75)	3.75* (1.59)
	Lahaul & Spiti									
P_1	-	-	-13.60** (4.28)	-20.44** (4.73)	-	-17.15** (4.07)	-	-16.16** (3.93)	3.74$^{n.s}$ (2.40)	-
P_2	-	2.47$^{n.s}$ (1.45)	-7.58** (1.15)	-2.71$^{n.s}$ (2.77)	-1.66$^{n.s}$ (5.72)	-3.60$^{n.s}$ (2.32)	-21.52** (5.10)	-5.95* (2.26)	-5.98** (0.86)	2.32$^{n.s}$ (7.66)
O	-	[30]8.39** (1.56)	-5.83** (1.23)	-3.73$^{n.s}$ (1.89)	-	-4.10* (1.52)	-	-4.41** (1.44)	3.75** (0.95)	-
	Mandi									
P_1	0.14$^{n.s}$ (0.93)	1.59$^{n.s}$ (0.87)	1.88$^{n.s}$ (1.40)	-1.34$^{n.s}$ (1.02)	-6.67* (2.47)	1.24$^{n.s}$ (0.69)	-5.65** (1.77)	1.13$^{n.s}$ (0.69)	3.01$^{n.s}$ (1.46)	-5.32$^{n.s}$ (2.53)
P_2	1.47* (0.68)	2.52** (0.75)	0.51$^{n.s}$ (1.34)	-0.17$^{n.s}$ (2.76)	-4.32$^{n.s}$ (3.61)	1.62* (0.61)	3.22$^{n.s}$ (1.59)	1.63* (0.61)	8.00** (2.07)	10.36** (2.30)
O	0.52$^{n.s}$ (0.28)	2.98** (0.30)	1.88** (0.48)	-0.63$^{n.s}$ (0.75)	-7.89** (1.09)	2.02** (0.23)	-1.84* (0.70)	1.97** (0.23)	6.71** (0.68)	4.07** (1.11)

[30] It is computed for the period 1978-79 to 2004-05.

Contd... *per cent per annum*

Period	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Shimla									
P_1	-0.19$^{n.s}$ (1.63)	0.85$^{n.s}$ (1.23)	-0.64$^{n.s}$ (1.36)	-3.84$^{n.s}$ (1.94)	-8.78** (1.41)	-0.95$^{n.s}$ (0.85)	-8.29** (2.08)	-1.02$^{n.s}$ (0.84)	-8.83** (1.80)	-3.41$^{n.s}$ (2.32)
P_2	-3.60** (1.07)	-2.17* (0.92)	-6.77* (1.37)	-2.80$^{n.s}$ (1.35)	-0.25$^{n.s}$ (2.51)	-3.70** (0.79)	2.42$^{n.s}$ (2.23)	-3.57** (0.76)	-1.38$^{n.s}$ (1.54)	5.70$^{n.s}$ (3.27)
O	-2.76** (0.48)	-0.10$^{n.s}$ (0.40)	-2.17** (0.59)	-2.89** (0.57)	-3.38** (0.81)	-1.45** (0.33)	1.52$^{n.s}$ (1.02)	-1.40** (0.32)	2.07$^{n.s}$ (1.03)	8.77** (1.38)
	Sirmaur									
P_1	2.33$^{n.s}$ (2.15)	1.07$^{n.s}$ (1.13)	0.35$^{n.s}$ (1.58)	-4.53$^{n.s}$ (2.16)	-6.11** (1.51)	0.75$^{n.s}$ (0.61)	-10.90** (1.75)	0.56$^{n.s}$ (0.61)	2.30$^{n.s}$ (4.01)	-3.81$^{n.s}$ (1.91)
P_2	1.14$^{n.s}$ (1.18)	-0.35$^{n.s}$ (0.78)	-1.15$^{n.s}$ (1.15)	-2.39* (1.11)	-5.16$^{n.s}$ (2.57)	-0.51$^{n.s}$ (0.69)	-5.83** (1.85)	-0.55$^{n.s}$ (0.69)	2.17$^{n.s}$ (2.42)	-0.10$^{n.s}$ (1.77)
O	1.94** (0.58)	1.24** (0.35)	0.94$^{n.s}$ (0.50)	-0.75$^{n.s}$ (0.65)	-3.99** (0.77)	1.04** (0.26)	-3.46** (0.85)	0.98** (0.26)	10.83** (1.51)	1.70* (0.77)
	Solan									
P_1	0.82$^{n.s}$ (1.81)	0.88$^{n.s}$ (0.87)	1.56$^{n.s}$ (2.30)	-4.10$^{n.s}$ (2.51)	-	1.06$^{n.s}$ (0.84)	-17.44** (3.61)	0.45$^{n.s}$ (0.84)	-5.11* (1.81)	-14.00** (3.25)
P_2	3.97** (0.98)	-1.19$^{n.s}$ (0.61)	0.59$^{n.s}$ (1.43)	-1.90$^{n.s}$ (2.12)	-	-0.15$^{n.s}$ (0.66)	-3.25$^{n.s}$ (2.31)	-0.18$^{n.s}$ (0.65)	-0.73$^{n.s}$ (1.52)	3.42$^{n.s}$ (2.87)
O	2.12** (0.51)	0.81** (0.29)	3.00** (0.68)	0.76$^{n.s}$ (0.91)	-	1.57** (0.29)	-7.37** (1.29)	1.30** (0.29)	1.01$^{n.s}$ (0.74)	-3.30* (1.35)

Contd... *per cent per annum*

Period	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Una									
P_1	-3.71* (1.41)	1.42$^{n.s}$ (0.98)	2.00$^{n.s}$ (1.48)	-	-	1.50$^{n.s}$ (0.80)	-20.02** (2.24)	0.51$^{n.s}$ (0.76)	0.86$^{n.s}$ (3.49)	-0.55$^{n.s}$ (2.47)
P_2	6.55** (1.67)	2.40** (0.80)	2.41* (1.10)	-	-	2.48** (0.52)	-6.16** (1.26)	2.44** (0.53)	11.06** (2.34)	6.98** (1.64)
O	3.68** (0.74)	1.97** (0.31)	3.45** (0.46)	-	-	2.64** (0.24)	-10.05** (0.96)	2.27** (0.25)	8.41** (1.16)	5.01** (0.81)

Note: (**) denotes significance at 1% probability level. (*) denotes significance at 5% probability level. (n.s) denotes non-significance at 5% probability level.
Figures in brackets denote standard errors of growth rates.

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

Changes in cropping pattern in terms of per cent change in acreage allocation were discussed in one of the earlier sections. To better understand the trends in cropping pattern, compound annual growth rates of area under major crops and crop groups were computed and explained below. Table 4.3.4 demonstrates district wise compound annual growth rates of area under major crops and crop groups in Himachal Pradesh from 1972-73 to 2004-05. This overall period was further divided into two sub-periods i.e. first period from 1972-73 to 1987-88 and second period from 1988-89 to 2004-05. By simply eyeballing the table for the state, it can be observed that area under rice went down continuously at the rate of 0.40 per cent, 0.62 per cent and 0.68 per cent per annum (% p.a.) during the first, second and overall periods, respectively. In the same fashion, area put to 'other cereals' declined over all the three periods registering annual growth rates of 3.19 per cent, 1.99 per cent and 2.85 per cent, in that order. Area allocated to pulses followed the same declining trend over all the periods with growth rates of 4.15 per cent, 3.72 per cent and 3.66 per cent per annum, respectively. Contrarily, area under maize grew up in the first period (1.16% p.a.) but it decreased during the second period (0.43% p.a.) and finally it went up (0.46% p.a.) as far as the overall period was concerned. Likewise, area allotted to wheat increased (1.43% p.a.) over the first period whereas it came down (0.22% p.a.) in the second period and ultimately grew up (0.41% p.a.) during the overall period of study. Area devoted to foodgrains underwent a decline in the second (0.57% p.a.) and the overall (0.16% p.a.) periods while it grew up (0.35% p.a.) during the first period.

Himachal Pradesh is known for its apple throughout the country. Area allocated to fruit production increased considerably in the state during the last four decades. Apple, the main fruit crop, acreage grew up during the first (5.78% p.a.), second (2.63% p.a.) and overall (4.54% p.a.) periods. In the same line, area under fruits other than apple also went up over all the periods at the rates of 7.87 per cent, 6.08 per cent and 5.54 per cent per annum, in that order. Area under other vegetables increased during all the periods recording yearly growth rates of 6.65 per cent, 5.96 per cent and 6.31 per cent, respectively. However, there was no significant increase or decrease in area put under potato during all the periods. Area under oilseeds decreased during all the periods but the decline was not significant in the first period. Area allotted to fodder grew up over all the periods but the increase was not significant during the first period. It can be inferred that, cropping pattern has shifted in favour of vegetables other than potato, fruits, partly major cereals i.e. maize and wheat; and fodder crops. Thus, relative profit and food security concerns could be the main motives behind this shift in acreage allocation in the state (Mehta 2009).

An analysis of compound annual growth rates of area under major crops and crop groups at the district level revealed that among the rice producing districts, acreage of rice decreased in Hamirpur (2.73% p.a.), Una (2.44% p.a.) and Shimla (1.31% p.a.) while the ups or downs were, however, not significant during the first period in the remaining districts. It was observed that in the second period Bilaspur, Hamirpur, Kullu, Mandi and Shimla registered decelerating trends with annual growth rates ranging from 0.96 per cent in Mandi to 4.90 per cent in Bilaspur whereas it went up in Una (3.97% p.a.), Kinnaur (3.16% p.a.) and Sirmaur (0.82% p.a.). The increases or decreases were not significant in other districts. During the overall study period somewhat similar trend was observed: area allotted to rice decreased in Bilaspur (3.12% p.a.), Hamirpur (3.08% p.a.), Shimla (2.98% p.a.), Kullu (2.53% p.a.) and Mandi (0.88% p.a.) but it increased in Sirmaur (0.30% p.a.) alone. However, the ups or downs were not significant in rest of the districts.

The assessment of trends in area allocated to maize over the whole study period demonstrated that it grew up significantly in most of the districts (eight) with growth rates ranging from 0.27 per cent per annum in Chamba to 3.27 per cent per annum in Lahaul & Spiti whereas it declined considerably in Shimla (1.18% p.a.). The trend was interesting during the first period when area put to maize grew up conspicuously in all the districts with annual growth rates varying from 0.39 per cent in Shimla to 5.57 per cent in Lahaul & Spiti. A shift was observed in the second period, such that area of maize increased considerably in Lahaul & Spiti (3.86% p.a.) and Kangra (0.24% p.a.) while it declined in Shimla (3.10% p.a.), Kinnaur (2.98% p.a.), Sirmaur (0.87% p.a.) and Solan (0.76% p.a.).

A look into the growth of area allotted to wheat during the first period showed that it went up in most of the districts (nine) recording significant growth rates ranging from 0.56 per cent per annum in Sirmaur to 3.50 per cent per annum in Una while it declined only in the tribal districts of Kinnaur (3.36% p.a.) and Lahaul & Spiti (2.62% p.a.). The scenario changed substantially in the second period: Bilaspur being the only district where acreage of wheat increased significantly (0.27% p.a.) whereas it declined in Lahaul & Spiti (6.33% p.a.), Kinnaur (5.62% p.a.), Shimla (4.56% p.a.), Sirmaur (0.86% p.a.) and Hamirpur (0.27% p.a.). The ups or downs were not significant in rest of the districts. However, during the overall period area allocated to wheat went up in majority of the districts (eight) with yearly growth rates varying from 0.52 per cent in Kangra to 1.18 per cent in Kullu, but it declined in Kinnaur (5.36% p.a.), Lahaul & Spiti (4.72% p.a.), Shimla (2.27% p.a.) and Sirmaur (0.18% p.a.).

Area devoted to other cereals decreased in most of the districts (nine) over the first period registering growth rates ranging from 1.49 per cent per annum in Kangra to 22.98 per cent per annum in Hamirpur while an increasing trend was observed in Bilaspur (5.44% p.a.). The trend converged in the second period when all the districts except Chamba secured significant declining annual growth rates varying from 1.56 per cent in Solan to 27.87 per cent in Una. This trend almost sustained for the overall period as well: apart from Bilaspur and Una wherein the decline was not considerable, the rest of the districts registered significant decrease in acreage put to 'other cereals' with per annum growth rates ranging from 1.22 per cent in Solan to 6.31 per cent in Hamirpur.

As far as growth in area under pulses is concerned, it came down in most of the districts during the first period but the decline was significant only in half of the districts (six) with yearly growth rates ranging from 2.43 per cent in Sirmaur to 12.34 per cent in Una whereas it increased in Kinnaur (5.55% p.a.) and Kullu (1.01% p.a.). It continued the downward trend even in the second period in a way that majority of the districts recorded growth rates between 0.46 per cent per annum in Chamba and 16.24 per cent per annum in Hamirpur. Kinnaur and Lahaul & Spiti were the two districts where acreage under pulses increased but it was, anyhow, not significant for the latter. However, the similar trend continued during the overall study period when majority of the districts experienced a downturn with annual growth rates ranging from 2.29 per cent in Mandi to 13.17 per cent in Hamirpur, except Kinnaur where significant increase was recorded.

An analysis of the growth of acreage under apple during the overall study period revealed that it went up significantly in Chamba (13.56% p.a.), Lahaul & Spiti (11.51% p.a.), Kinnaur (9.26% p.a.), Shimla (5.46% p.a.) and Kullu (5.30% p.a.) while Mandi, Solan and Sirmaur registered decline which was considerable (2.60% p.a.) for the former but not significant for the latter two. Among the apple growing districts, five of them registered yearly growth rates ranging from 2.76 per cent in Sirmaur to 20.87 per cent in Chamba whereas Mandi experienced a considerable decrease at the rate of 7.49 per cent per annum during the first period. The trend changed slightly in the second period: area under apple grew up in Solan (22.09% p.a.), Lahaul & Spiti (12.89% p.a.), Kinnaur (4.89% p.a.), Shimla (3.60% p.a.), Kullu (2.55% p.a.) while it came down in Mandi (8.60% p.a.) and Sirmaur (2.69% p.a.). Furthermore, area allocated to fruits other than apple i.e. other fruits, during the first period increased in Kullu (20.97% p.a.), Mandi (14.49% p.a.), Kangra (12.31% p.a.) and Bilaspur (6.73% p.a.) whereas it declined in Chamba (15.90% p.a.). However, the increases or decreases were not significant in rest of the districts. An interesting trend was evident in the second period, when area put to other fruits increased

in all the districts but the growth was not significant for some of the districts (four). Those districts witnessed considerable growth, recorded annual growth rates ranging from 3.74 per cent in Sirmaur to 13.17 per cent in Shimla. However, during the overall study period area devoted to other fruits went up in most of the districts (nine) at the rates ranging from 2.23 per cent per annum in Sirmaur to 19.14 per cent per annum in Shimla.

An uneven trend was observed while assessing trends in area put under potato over the entire study period. It was found that half of the districts (six) experienced increasing trends with annual growth rates varying from 0.74 per cent in Kullu to 7.08 per cent in Una whereas it came down in Kinnaur (2.84% p.a.), Solan (2.27% p.a.) and Shimla (1.40% p.a.). The ups or downs were not considerable in the remaining districts. The first and second periods portrayed a mixed picture comprising both increases and decreases in acreage under potato. Shimla witnessed a continuous decline while Sirmaur and Una experienced a ceaseless increase in area under potato during all the periods.

One of the emerging trends in Himachal Pradesh agriculture is increase in area under vegetables other than potato i.e. other vegetables. An examination of the growth path of area allotted to other vegetables brought out that it grew up in majority of the districts (eight) over the first period with yearly growth rates ranging from 3.35 per cent in Una to 15.82 per cent in Mandi while the upwards or downwards growth rates were not significant in rest of the districts. The trend continued its path in the second period but with some minor changes. Chamba and Hamirpur improved by showing considerable growth rates but Lahaul & Spiti and Una went behind by recording non significant growth rates. However, during the overall study period, area put to other vegetables increased in most of the districts (nine) registering growth rates ranging from 1.25 per cent per annum in Kangra to 12.19 per cent per annum in Kinnaur while the increases or decreases were not conspicuous in the remaining districts.

The growth analysis of area put to oilseeds for the overall period revealed that it went down in Hamirpur (3.19% p.a.), Bilaspur (1.94% p.a.), Kangra (1.83% p.a.) and Solan (1.78% p.a.) whereas it grew up in Shimla (4.08% p.a.), Una (1.87% p.a.), Kullu (1.66% p.a.) and Mandi (0.77% p.a.). For one reason or another, the ups or downs were not significant in rest of the districts. Besides, area allocated to fodder crops increased in half of the districts (six) during the overall study period with annual growth rates varying from 1.56 per cent in Mandi to 7.15 per cent in Hamirpur while it was not considerable for the remaining districts.

Table 4.3.4 Compound Annual Growth Rates of Area under Various Crops in Himachal Pradesh, 1972-73 to 2004-05.

(per cent per annum)

Period[31]	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Himachal Pradesh											
P_1	-0.40* (0.16)	1.16** (0.09)	1.43** (0.17)	-3.19** (0.20)	-4.15** (0.66)	0.35** (0.05)	5.78** (0.43)	7.87** (1.34)	-0.17$^{n.s}$ (0.31)	6.65** (0.50)	-0.03$^{n.s}$ (0.32)	0.63$^{n.s}$ (0.79)
P_2	-0.62** (0.16)	-0.43** (0.06)	-0.22* (0.08)	-1.99** (0.19)	-3.72** (0.30)	-0.57** (0.05)	2.63** (0.22)	6.08** (1.26)	0.29$^{n.s}$ (0.71)	5.96** (1.00)	-1.56** (0.22)	0.52* (0.18)
O	-0.68** (0.06)	0.46** (0.08)	0.41** (0.09)	-2.85** (0.09)	-3.66** (0.17)	-0.16** (0.04)	4.54** (0.19)	5.54** (0.47)	0.06$^{n.s}$ (0.20)	6.31** (0.28)	-0.71** (0.12)	1.60** (0.22)
	Bilaspur											
P_1	-1.39$^{n.s}$ (0.91)	1.45** (0.23)	2.67** (0.31)	5.44** (1.50)	-9.36** (1.05)	0.73** (0.13)	-	6.73** (1.66)	4.83$^{n.s}$ (2.90)	0.30$^{n.s}$ (0.29)	2.62** (1.17)	1.52$^{n.s}$ (0.96)
P_2	-4.90** (0.56)	-0.09$^{n.s}$ (0.13)	0.27** (0.09)	-6.76** (1.96)	-12.06** (1.56)	-0.38** (0.08)	-	2.12$^{n.s}$ (1.51)	-3.46* (1.38)	0.85$^{n.s}$ (1.17)	-6.22** (0.70)	-2.04$^{n.s}$ (1.17)
O	-3.12** (0.30)	0.75** (0.09)	1.08** (0.13)	-0.67$^{n.s}$ (0.83)	-10.03** (0.49)	0.13* (0.06)	-	6.35** (0.63)	0.34$^{n.s}$ (0.82)	3.26** (0.42)	-1.94** (0.51)	-0.33$^{n.s}$ (0.41)
	Chamba											
P_1	-0.16$^{n.s}$ (0.28)	0.48** (0.14)	1.16** (0.16)	-1.99** (0.36)	0.10$^{n.s}$ (0.32)	0.25* (0.11)	20.87* (9.12)	-15.90* (6.13)	-1.27** (0.31)	-3.16$^{n.s}$ (2.38)	1.23* (0.52)	[32]5.12$^{n.s}$ (5.60)
P_2	-1.15$^{n.s}$ (1.04)	0.24$^{n.s}$ (0.41)	0.44$^{n.s}$ (0.42)	-0.79$^{n.s}$ (0.67)	-0.46* (0.21)	0.07$^{n.s}$ (0.24)	0.97$^{n.s}$ (1.02)	7.07$^{n.s}$ (14.43)	1.73** (0.24)	5.97** (1.16)	1.61* (0.64)	[33]5.27$^{n.s}$ (9.84)
O	-0.41$^{n.s}$ (0.28)	0.27* (0.11)	0.76** (0.12)	-2.46** (0.23)	-0.12$^{n.s}$ (0.09)	0.05$^{n.s}$ (0.07)	13.56** (2.21)	-4.31$^{n.s}$ (3.81)	1.27** (0.19)	3.28** (0.78)	0.25$^{n.s}$ (0.23)	-

[31] P_1 = First Period (1972-73 to 1987-88). P_2 = Second Period (1988-89 to 2004-05). O = Overall Period (1972-73 to 2004-05.

[32] It is computed for the period 1972-73 to 1983-84.

[33] It is computed for the period 1972-73 to 1983-84.

Contd... *per cent per annum*

Period	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Hamirpur											
P_1	-2.73** (0.44)	1.72** (0.31)	3.18** (0.80)	-22.98* (9.48)	-9.17** (1.92)	0.30* (0.11)	-	1.63$^{n.s}$ (1.81)	-8.04** (2.02)	-2.76$^{n.s}$ (1.31)	-3.64$^{n.s}$ (2.85)	12.28** (2.70)
P_2	-1.99* (0.78)	-0.41$^{n.s}$ (0.22)	-0.27** (0.06)	-6.22** (0.93)	-16.24** (0.93)	-0.52** (0.10)	-	10.68** (1.24)	0.93$^{n.s}$ (2.18)	3.29* (1.29)	-3.47* (1.28)	4.64** (0.29)
O	-3.08** (0.24)	0.78** (0.13)	0.81** (0.24)	-6.31* (2.88)	-13.17** (0.58)	-0.13* (0.05)	-	7.04** (0.67)	-0.70$^{n.s}$ (0.89)	-0.37$^{n.s}$ (0.52)	-3.19** (0.73)	7.15** (0.69)
	Kangra											
P_1	-0.07$^{n.s}$ (0.33)	1.29* (0.54)	1.05** (0.34)	-1.49* (0.57)	-4.04** (1.03)	0.59$^{n.s}$ (0.32)	-	12.31** (1.09)	-0.46$^{n.s}$ (1.19)	0.57$^{n.s}$ (1.41)	-1.59** (0.48)	1.63$^{n.s}$ (2.83)
P_2	-0.21$^{n.s}$ (0.22)	0.24** (0.07)	0.37$^{n.s}$ (0.23)	-1.60** (0.53)	-2.97** (0.38)	0.09$^{n.s}$ (0.12)	-	7.79* (2.68)	2.89** (0.38)	-0.08$^{n.s}$ (0.67)	-2.94** (0.30)	1.23* (0.52)
O	0.002$^{n.s}$ (0.096)	0.70** (0.13)	0.52** (0.10)	-2.13** (0.20)	-3.56** (0.26)	0.25** (0.08)	-	6.79** (0.81)	2.59** (0.36)	1.25** (0.38)	-1.83** (0.16)	3.50** (0.70)
	Kinnaur											
P_1	-2.55$^{n.s}$ (1.73)	4.67** (0.42)	-3.36** (0.39)	-3.26** (0.23)	5.55** (0.85)	-2.56** (0.19)	16.24** (0.84)	2.21$^{n.s}$ (1.19)	-0.11$^{n.s}$ (0.66)	8.57** (2.83)	17.02* (5.83)	-
P_2	3.16** (0.96)	-2.98** (0.60)	-5.62** (0.38)	-2.63** (0.23)	1.85* (0.79)	-2.19** (0.19)	4.89** (0.38)	0.59$^{n.s}$ (0.98)	-3.35** (0.39)	14.28** (4.34)	-23.25** (2.81)	-
O	-0.70$^{n.s}$ (0.54)	0.25$^{n.s}$ (0.39)	-5.36** (0.18)	-3.15** (0.09)	5.25** (0.38)	-2.49** (0.07)	9.26** (0.55)	2.38** (0.40)	-2.84** (0.25)	12.19** (1.31)	-2.60$^{n.s}$ (2.38)	-

Contd... *per cent per annum*

Period	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Kullu											
P_1	-1.72$^{n.s}$ (1.50)	2.29** (0.15)	1.05** (0.17)	-3.80** (0.20)	1.01** (0.42)	0.24$^{n.s}$ (0.12)	9.30** (0.71)	20.97** (2.25)	0.22$^{n.s}$ (0.93)	10.27** (1.48)	2.57$^{n.s}$ (1.36)	8.49$^{n.s}$ (6.62)
P_2	-2.98** (0.45)	-0.30$^{n.s}$ (0.41)	0.84$^{n.s}$ (0.45)	-1.81* (0.77)	-2.02** (0.49)	-0.18$^{n.s}$ (0.27)	2.55** (0.50)	6.11** (0.67)	2.37* (0.99)	4.23** (1.06)	1.19$^{n.s}$ (0.74)	2.36$^{n.s}$ (2.54)
O	-2.53** (0.36)	1.05** (0.16)	1.18** (0.13)	-3.42** (0.23)	-0.22$^{n.s}$ (0.21)	0.14$^{n.s}$ (0.08)	5.30** (0.36)	10.56** (0.85)	0.74* (0.35)	6.72** (0.51)	1.66** (0.37)	6.12** (1.64)
	Lahaul & Spiti											
P_1	-	[34]5.57* (1.93)	-2.62** (0.78)	-2.62** (0.68)	-	-2.48** (0.64)	-	-	8.06** (1.88)	5.32** (1.25)	-3.79* (1.61)	-
P_2	-	3.86** (1.07)	-6.33** (0.56)	-2.53** (0.38)	[35]20.64$^{n.s}$ (14.78)	1.12$^{n.s}$ (1.83)	12.89** (3.34)	-	-2.06** (0.35)	-11.70$^{n.s}$ (7.06)	5.82$^{n.s}$ (3.30)	-
O	-	[36]3.27** (0.50)	-4.72** (0.28)	-2.96** (0.19)	-	-1.67** (0.52)	[37]11.51** (1.92)	-	0.59$^{n.s}$ (0.63)	2.19$^{n.s}$ (2.37)	0.60$^{n.s}$ (0.99)	-
	Mandi											
P_1	0.13$^{n.s}$ (0.29)	1.20** (0.36)	1.40** (0.26)	-2.71** (0.39)	0.95$^{n.s}$ (0.65)	0.76** (0.20)	-7.49** (2.52)	14.49* (5.16)	0.78$^{n.s}$ (0.44)	15.82** (1.83)	0.77$^{n.s}$ (0.48)	-0.57$^{n.s}$ (1.38)
P_2	-0.96** (0.12)	-0.20$^{n.s}$ (0.10)	-0.13$^{n.s}$ (0.11)	-1.86** (0.45)	-3.64** (0.40)	-0.45** (0.07)	-8.60** (1.87)	8.91** (1.17)	1.63$^{n.s}$ (1.12)	3.40* (1.35)	0.41$^{n.s}$ (0.67)	0.84$^{n.s}$ (0.47)
O	-0.88** (0.10)	0.97** (0.12)	0.58** (0.09)	-3.05** (0.17)	-2.29** (0.28)	0.12$^{n.s}$ (0.07)	-2.60* (0.98)	7.61** (1.23)	1.03** (0.31)	7.86** (0.77)	0.77** (0.21)	1.56** (0.38)

[34] It is computed for the period 1947-75 to 1787-88.
[35] It is computed for the period 1992-93 to 2004-05.
[36] It is computed for the period 1974-75 to 2004-05.
[37] It is computed for the period 1982-83 to 2004-05.

Contd... *per cent per annum*

Period	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Shimla											
P_1	-1.31** (0.26)	0.39** (0.11)	0.13$^{n.s}$ (0.24)	-2.34** (0.26)	-0.51$^{n.s}$ (0.28)	-0.53** (0.16)	7.13** (0.51)	[38]12.36$^{n.s}$ (11.63)	-1.52** (0.48)	5.10** (0.54)	5.17** (1.48)	-
P_2	-3.92** (0.46)	-3.10** (0.18)	-4.56** (0.46)	-2.97** (0.22)	-2.11** (0.67)	-3.56** (0.25)	3.60** (0.25)	13.17** (3.77)	-1.78* (0.79)	7.81** (1.91)	-0.30$^{n.s}$ (1.52)	-
O	-2.98** (0.18)	-1.18** (0.17)	-2.27** (0.25)	-2.91** (0.09)	0.58$^{n.s}$ (0.29)	-1.95** (0.16)	5.46** (0.21)	[39]19.14** (2.90)	-1.40** (0.23)	5.88** (0.52)	4.08** (0.62)	-
	Sirmaur											
P_1	-0.30$^{n.s}$ (0.30)	0.59** (0.13)	0.56** (0.19)	-1.81** (0.45)	-2.43** (0.47)	0.12$^{n.s}$ (0.13)	2.76** (0.59)	-3.58$^{n.s}$ (1.92)	3.19** (0.77)	12.37** (0.80)	2.25* (0.86)	5.17* (1.99)
P_2	0.82** (0.25)	-0.87** (0.12)	-0.86** (0.14)	-2.53** (0.39)	-3.86** (0.84)	-0.96** (0.09)	-2.69** (0.33)	3.74** (0.73)	2.08* (0.78)	9.55** (1.91)	0.19$^{n.s}$ (0.76)	0.29$^{n.s}$ (0.15)
O	0.30** (0.11)	-0.07$^{n.s}$ (0.08)	-0.18* (0.08)	-2.12** (0.15)	-2.69** (0.26)	-0.37** (0.06)	-0.15$^{n.s}$ (0.29)	2.23** (0.63)	2.79** (0.27)	11.52** (0.55)	0.48$^{n.s}$ (0.30)	2.18** (0.49)
	Solan											
P_1	0.11$^{n.s}$ (0.65)	0.53** (0.17)	1.10* (0.47)	-1.29$^{n.s}$ (1.48)	-3.99** (1.24)	-0.05$^{n.s}$ (0.22)	-	-0.20$^{n.s}$ (6.20)	-1.73* (0.76)	6.53** (0.86)	-0.92$^{n.s}$ (0.76)	-0.66$^{n.s}$ (2.44)
P_2	0.55$^{n.s}$ (0.66)	-0.76** (0.16)	-0.40$^{n.s}$ (0.20)	-1.56** (0.43)	-6.40** (0.70)	-0.89** (0.12)	[40]22.09** (5.38)	0.87$^{n.s}$ (0.56)	-0.97$^{n.s}$ (0.91)	5.29** (0.92)	-2.22** (0.56)	-1.58** (0.30)
O	-0.47$^{n.s}$ (0.24)	-0.03$^{n.s}$ (0.08)	0.58** (0.14)	-1.22** (0.36)	-5.91** (0.35)	-0.46** (0.07)	[41]-4.64$^{n.s}$ (5.72)	3.02$^{n.s}$ (1.48)	-2.27** (0.30)	6.55** (0.32)	-1.78** (0.23)	1.73* (0.65)

[38] It is computed for the period 1973-74 to 1987-88.
[39] It is computed for the period 1973-74 to 2004-05.
[40] It is computed for the period 1988-89 to 1998-99.
[41] It is computed for the period 1979-80 to 1998-99.

Contd... *per cent per annum*

Period	Crops & Crop Groups											
	Rice	Maize	Wheat	Other Cereals	Pulses	Foodgrains	Apple	Other Fruits	Potato	Other Vegetables	Oilseeds	Fodder
	Una											
P_1	-2.44** (0.70)	1.75** (0.24)	3.50** (0.49)	-9.17$^{n.s}$ (4.63)	-12.34** (1.56)	0.88** (0.15)	-	-2.28$^{n.s}$ (2.06)	7.36* (2.67)	3.35** (1.06)	5.24** (1.06)	-0.89$^{n.s}$ (0.53)
P_2	3.97** (1.07)	-0.41$^{n.s}$ (0.30)	0.35$^{n.s}$ (0.28)	[42] 27.87** (6.58)	-8.60** (0.53)	-0.08$^{n.s}$ (0.22)	-	9.24** (1.93)	7.86** (1.39)	1.20$^{n.s}$ (1.31)	-1.85** (0.54)	0.78$^{n.s}$ (0.58)
O	0.12$^{n.s}$ (0.43)	0.62** (0.14)	1.06** (0.20)	-5.39$^{n.s}$ (2.73)	-9.55** (0.43)	0.13$^{n.s}$ (0.08)	-	6.72** (0.93)	7.08** (0.70)	1.93** (0.43)	1.87** (0.42)	-0.32$^{n.s}$ (0.21)

Note: (**) denotes significance at 1% probability level. (*) denotes significance at 5% probability level. (n.s) denotes non-significance at 5% probability level.
Figures in brackets denote standard errors of growth rates.

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

[42] It is computed for the period 1988-89 to 2000-01.

Table 4.3.5 portrays compound annual growth rates of the productivity of major crops and crop groups in Himachal Pradesh from 1972-73 to 2004-05. This overall period was further divided into two sub-periods i.e. first period from 1972-73 to 1987-88 and second period from 1988-89 to 2004-05. By simply looking at the table for the state, it can be easily seen that the yields of rice, maize, barley, 'other cereals', total cereals, pulses, potato and oilseeds declined during the first period which was, however, only significant for pulses and oilseeds with growth rates of -6.02 per cent and -7.03 per cent per annum (% p.a.), respectively. An increase, though non-significant, in the yield of wheat and foodgrains was also observed. The trend changed in the second period such that rice, maize, other cereals, total cereals, pulses, foodgrains, potato and oilseeds recorded growth in productivity but the increase was significant for rice (1.71% p.a.), pulses (2.63% p.a.) and oilseeds (4.33% p.a.) only. Analysis of the growth performance of yield during the entire study period demonstrated that it increased significantly for potato (4.12% p.a.), wheat (1.47% p.a.), foodgrains (1.42% p.a.), total cereals (1.30% p.a.), rice (1.18% p.a.) and maize (1.04% p.a.) while the increase was not significant for barley, other cereals, pulses and oilseeds. Thus, it may be inferred from these observations that at the aggregated level of state, productivity grew up for most of the crops and crops groups during the last four decades or so. But when this entire period was decomposed into two sub-periods it became evident that the yields of most of the crops and crop groups witnessed increase during the second period of study while a decline was observed during the first period.

An assessment of the growth of crop yields at disaggregated level of districts revealed that there was no significant increase or decrease in the yield of rice during the first period in all the districts. A new trend emerged in the second period when the productivity of rice grew up considerably in Solan (3.40% p.a.), Una (2.48% p.a.), Mandi (2.45% p.a.) and Kangra (2.09% p.a.) while the increase in the rice yield was not significant in rest of the districts. This clearly suggested that yield growth in rice took place during the second period in all the districts. However, over the entire study period analysis showed that all the districts experienced increase in the yield of rice but it was only significant in Una (3.55% p.a.), Solan (2.60% p.a.), Sirmaur (1.63% p.a.), Mandi (1.42% p.a.), Hamirpur (1.21% p.a.), Chamba (1.08% p.a.) and Kinnaur (0.85% p.a.). In case of maize productivity, no considerable increase (six) or decrease (five) over the first period was observed. Upward growth was evident in majority of the districts (nine) during the second period but it was significant in Una (2.82% p.a.), Bilaspur (2.78% p.a.) and

Mandi (2.72% p.a.) alone, while a non-significant decline was observed in the yield of maize in Chamba, Lahaul & Spiti and Solan districts. Thus, the yield of maize seems to have increased more in the second period than that in the first period. However, the overall trend was fascinating for all the districts depicting perceptible growth in the yield of maize. The growth rates were significant in most of the districts (nine) ranging from 0.84 per cent per annum in Solan to 5.48 per cent per annum in Lahaul & Spiti.

The growth path of wheat productivity showed that it went up in Kullu (3.30% p.a.) while it came down in the tribal districts of Kinnaur (3.59% p.a.) and Lahaul & Spiti (11.27% p.a.) during the first period. The ups or downs were, however, not significant in the remaining districts. Kinnaur and Una were the only districts where conspicuous increase in the yield of wheat was observed in the second period with annual growth rates of 5.70 per cent and 2.05 per cent, in that order. As regards the overall period, majority of the districts (eight) witnessed considerable increase in the yield of wheat with growth rates ranging from 1.12 per cent per annum in Sirmaur to 2.41 per cent per annum in Solan. However, the increases or decreases were non-significant in rest of the districts. The yield of barley decreased in most of the districts (nine) but the decline was significant only in Lahaul & Spiti (18.98% p.a.) during the first period. The scenario changed in the second period when Kinnaur witnessed significant increase in the productivity of barley (4.49% p.a.) whereas a considerable downward growth was observed in Kullu (2.19% p.a.). The upwards or downwards growth rates were not conspicuous in the remaining districts. Over the whole study period though productivity of barley increased in majority of the districts (nine), yet the growth rates were not significant for all of them.

As regards the productivity of 'other cereals', it declined in Chamba (7.38% p.a.), Shimla (6.62% p.a.) and Sirmaur (3.70% p.a.) but the ups or downs were not significant in rest of the districts during the first period. Again, no perceptible growth in the yield of 'other cereals' was witnessed during the second period in all the districts. Analysis of the growth in yield of 'other cereals' during the overall period demonstrated that it increased in Kinnaur (1.72% p.a.) while it decreased in Kullu (3.47% p.a.) and Mandi (2.85% p.a.). The rest of the districts recorded no considerable growth in the yield of 'other cereals'. Furthermore, looking at the growth performance of the yield of total cereals during the first period revealed that it grew up considerably in Kullu (1.76% p.a.) but declined in Lahaul & Spiti (15.05% p.a.). The increases or decreases were, however, not significant in the other districts. But, during the second period the trend in the yield of total cereals was such

that majority of the districts (eight) experienced increase though it was significant only in Kinnaur (3.25% p.a.), Una (2.38% p.a.) and Mandi (1.99% p.a.). Most interesting trend was seen during the overall study period when all the districts, except Lahaul & Spiti where a non-significant decline was observed, witnessed increasing growth in the yield of total cereals with significant annual growth rates varying from 0.71 per cent in Shimla to 1.82 per cent in Una.

The growth analysis of the productivity of pulses displayed that it decreased in majority of the districts (ten) during the first period registering growth rates ranging from 6.54 per cent per annum in Mandi to 14.00 per cent per annum in Solan while it increased considerably only in Kinnaur (7.16% p.a.). The trend underwent a shift in the second period when most of the districts (nine) demonstrated upwards growth in the productivity of pulses although the increase was significant only in Kinnaur (14.74% p.a.), Mandi (7.11% p.a.), Shimla (4.62% p.a.), Kangra (3.83% p.a.) and Una (2.68% p.a.). Kullu, Lahaul & Spiti and Sirmaur were the districts that recorded a decline which was, however, non-significant. By looking at the complete trend of the yield of pulses it was evident that it increased in most of the districts (seven) but the increase was significant in Kinnaur (7.54% p.a.) and Kangra (1.03% p.a.) only. It decreased significantly in Kullu (1.98% p.a.) alone. Moreover, productivity trend of foodgrains depicted that it grew up in Kullu (6.87% p.a.) but declined in Lahaul & Spiti (14.02% p.a.) during the first period. The increases or decreases were, however, not significant in rest of the districts. Although, majority of the districts (nine) registered increase in the yield of foodgrains in the second period, it was solely significant in Kinnaur (4.35% p.a.), Una (2.52% p.a.) and Mandi (2.09% p.a.) whereas it diminished considerably in Lahaul & Spiti (6.99% p.a.). The trend became more fascinating in overall study period. That is to say, an absolute majority of the districts (eleven) experienced significant upward growth in the yield of foodgrains with annual growth rates varying from 0.56 per cent in Shimla to 2.49 per cent in Kullu while Lahaul & Spiti registered a decline which was not significant.

As far as cash crops are concerned, assessment of the growth path of potato productivity in the first period depicted that most of the districts (nine) witnessed decelerating growth but the growth rates were significant in Kullu (-15.05% p.a.), Chamba (-7.87% p.a.), Shimla (-7.42% p.a.), Hamirpur (-6.82% p.a.) and Solan (-3.44% p.a.). The

yield of potato grew up considerably in Bilaspur (9.47% p.a.) and Kinnaur (2.75% p.a.). The second period traced the trend of the yield of potato otherwise such that majority of the districts (nine) demonstrated increasing growth though it was significant only in Mandi (6.27% p.a.). A decline was also observed in a few districts but it was considerable in Lahaul & Spiti alone. As far as the entire study period is concerned, it was observed that most of the districts (ten) experienced significant increase in the yield of potato with growth rates varying from 3.14 per cent per annum in Lahaul & Spiti to 10.84 per cent per annum in Bilaspur. Kangra and Una recorded decrease and increase, respectively, which were, however, not significant.

The yield trend of oilseeds revealed that it declined in a large number of districts (nine) during the first period registering annual growth rates ranging from 5.14 per cent in Kangra to 13.76 per cent in Kullu. The trend turned otherwise in the second period such that several districts (ten) demonstrated increase in the yield of oilseeds but it was significant only in Mandi (9.91% p.a.), Hamirpur (9.06% p.a.), Una (8.99% p.a.), Shimla (6.02% p.a.), Solan (5.77% p.a.) and Kangra (4.73% p.a.). A similar growth path was observed in the yield of oilseeds during the overall study period when most of the districts (nine) recorded upward growth but the growth rates were significant in Hamirpur (5.79% p.a.), Shimla (4.51% p.a.), Mandi (3.27% p.a.), Una (3.08% p.a.) and Kangra (1.41% p.a.) only.

In conclusion, the analysis of growth performance of the yield of crops and crop groups studied revealed that most of them witnessed decline in productivity during the first period in majority of the districts. Contrary to this, a large number of districts experienced increase in the yield of majority of the crops and crop groups over the second period of the study. However, during the entire study period, a vast majority of the districts witnessed upwards growth in the yield of most of the crops and crop groups.

Table 4.3.5 Compound Annual Growth Rates of Yield of Various Crops in Himachal Pradesh, 1972-73 to 2004-05. ***(per cent per annum)***

Period[43]	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Himachal Pradesh									
P_1	-2.87$^{n.s}$ (1.88)	-0.21$^{n.s}$ (0.59)	0.02$^{n.s}$ (1.19)	-1.20$^{n.s}$ (0.81)	-0.55$^{n.s}$ (3.21)	-0.02$^{n.s}$ (0.54)	-6.02** (1.42)	0.08$^{n.s}$ (0.54)	-2.30$^{n.s}$ (1.67)	-7.03** (0.92)
P_2	1.71* (0.64)	1.12$^{n.s}$ (0.59)	-0.03$^{n.s}$ (1.14)	-0.39$^{n.s}$ (0.69)	1.52$^{n.s}$ (1.63)	0.79$^{n.s}$ (0.52)	2.63* (1.00)	0.91$^{n.s}$ (0.52)	0.49$^{n.s}$ (1.43)	4.33** (0.95)
O	1.18* (0.54)	1.04** (0.22)	1.47** (0.43)	0.33$^{n.s}$ (0.28)	-0.60$^{n.s}$ (0.85)	1.30** (0.21)	0.06$^{n.s}$ (0.60)	1.42** (0.21)	4.21** (0.78)	1.12$^{n.s}$ (0.65)
	Bilaspur									
P_1	-2.26$^{n.s}$ (1.60)	0.49$^{n.s}$ (1.69)	-2.60$^{n.s}$ (2.42)	-0.84$^{n.s}$ (0.75)	-	-1.28$^{n.s}$ (1.37)	-11.54** (3.11)	-0.72$^{n.s}$ (1.37)	9.47** (2.84)	-9.68** (3.62)
P_2	1.37$^{n.s}$ (1.71)	2.78* (1.18)	-0.18$^{n.s}$ (2.51)	-0.51$^{n.s}$ (0.67)	-	1.68$^{n.s}$ (0.92)	2.23$^{n.s}$ (1.52)	1.85$^{n.s}$ (0.92)	-1.43$^{n.s}$ (1.50)	2.71$^{n.s}$ (2.02)
O	0.85$^{n.s}$ (0.61)	1.42** (0.50)	1.38$^{n.s}$ (0.92)	0.37$^{n.s}$ (0.27)	-	1.33** (0.43)	1.38$^{n.s}$ (1.26)	1.68** (0.43)	10.84** (1.23)	1.16$^{n.s}$ (1.28)
	Chamba									
P_1	1.10$^{n.s}$ (1.09)	-0.79$^{n.s}$ (0.98)	1.77$^{n.s}$ (1.15)	0.83$^{n.s}$ (2.63)	-7.38* (2.64)	0.05$^{n.s}$ (0.71)	-8.56** (1.84)	-0.02$^{n.s}$ (0.71)	-7.87** (2.49)	-10.63** (2.29)
P_2	1.32$^{n.s}$ (0.71)	-0.58$^{n.s}$ (0.66)	-1.01$^{n.s}$ (1.12)	-1.33$^{n.s}$ (0.89)	0.43$^{n.s}$ (2.14)	-0.50$^{n.s}$ (0.58)	4.45$^{n.s}$ (2.42)	-0.45$^{n.s}$ (0.58)	2.49$^{n.s}$ (1.65)	4.00$^{n.s}$ (2.12)
O	1.08** (0.31)	1.51** (0.37)	1.53** (0.43)	1.09$^{n.s}$ (0.67)	-0.17$^{n.s}$ (0.97)	1.57** (0.29)	0.55$^{n.s}$ (0.99)	1.57** (0.29)	10.72** (1.74)	0.77$^{n.s}$ (1.11)

[43] P_1 = First Period (1972-73 to 1987-88). P_2 = Second Period (1988-89 to 2004-05). O = Overall Period (1972-73 to 2004-05).

Contd... *(per cent per annum)*

Period	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Hamirpur									
P_1	-1.72$^{n.s}$ (1.92)	-1.22$^{n.s}$ (1.14)	-3.66$^{n.s}$ (2.12)	-0.48$^{n.s}$ (0.72)	-1.86$^{n.s}$ (6.88)	-1.26$^{n.s}$ (1.05)	-10.40** (2.91)	-0.95$^{n.s}$ (1.02)	-6.82* (3.01)	-1.89$^{n.s}$ (2.86)
P_2	0.63$^{n.s}$ (1.27)	0.93$^{n.s}$ (0.91)	0.15$^{n.s}$ (2.44)	-0.32$^{n.s}$ (0.70)	2.76$^{n.s}$ (3.41)	0.89$^{n.s}$ (0.84)	3.70$^{n.s}$ (2.80)	0.99$^{n.s}$ (0.84)	0.57$^{n.s}$ (2.78)	9.06** (2.81)
O	1.21* (0.59)	0.60$^{n.s}$ (0.37)	1.31$^{n.s}$ (0.88)	0.42$^{n.s}$ (0.26)	2.07$^{n.s}$ (1.86)	1.26** (0.37)	0.99$^{n.s}$ (1.29)	1.50** (0.36)	9.17** (1.77)	5.79** (1.13)
	Kangra									
P_1	-1.05$^{n.s}$ (1.01)	-0.18$^{n.s}$ (0.53)	0.89$^{n.s}$ (1.25)	-0.60$^{n.s}$ (1.11)	[44]-8.45$^{n.s}$ (5.47)	0.15$^{n.s}$ (0.60)	-2.22$^{n.s}$ (1.08)	0.29$^{n.s}$ (0.60)	-4.18$^{n.s}$ (2.13)	-5.14** (0.87)
P_2	2.09* (0.85)	0.36$^{n.s}$ (0.77)	-0.97$^{n.s}$ (1.30)	-0.84$^{n.s}$ (1.39)	[45]-6.46$^{n.s}$ (8.06)	-0.01$^{n.s}$ (0.60)	3.83** (1.02)	0.07$^{n.s}$ (0.60)	3.61$^{n.s}$ (2.76)	4.73** (1.35)
O	0.35$^{n.s}$ (0.35)	0.07$^{n.s}$ (0.23)	1.45** (0.48)	0.85$^{n.s}$ (0.47)	-	0.79** (0.22)	1.03* (0.45)	0.90** (0.22)	-0.90$^{n.s}$ (0.91)	1.41* (0.61)
	Kinnaur									
P_1	-0.33$^{n.s}$ (0.88)	3.43$^{n.s}$ (1.92)	-3.59* (1.40)	-3.64$^{n.s}$ (2.01)	1.17$^{n.s}$ (2.13)	0.24$^{n.s}$ (1.12)	7.16** (1.73)	0.13$^{n.s}$ (1.10)	2.75* (1.15)	-
P_2	0.94$^{n.s}$ (0.71)	1.10$^{n.s}$ (0.62)	5.70** (1.16)	4.49** (1.18)	1.27$^{n.s}$ (1.31)	3.25** (0.78)	14.74** (2.35)	4.35** (0.59)	-2.38$^{n.s}$ (1.95)	13.57$^{n.s}$ (7.09)
O	0.85** (0.28)	0.95$^{n.s}$ (0.48)	1.79* (0.61)	1.37$^{n.s}$ (0.68)	1.72* (0.59)	1.72** (0.35)	7.54** (0.85)	1.93** (0.35)	3.86** (0.76)	-

[44] It is computed for the period 1972-73 to 1986-87.
[45] It is computed for the period 1990-91 to 2004-05.

Contd...

per cent per annum

Period	Crops and Crop Groups									
	Rice	**Maize**	**Wheat**	**Barley**	**Other Cereals**	**Total Cereals**	**Pulses**	**Foodgrains**	**Potato**	**Oilseeds**
	Kullu									
P_1	-0.62$^{n.s}$ (1.84)	-0.17$^{n.s}$ (1.10)	3.30* (1.16)	1.65$^{n.s}$ (0.99)	-3.57$^{n.s}$ (2.25)	1.76* (0.74)	-8.62** (1.96)	6.87* (2.95)	-15.05** (2.95)	-13.76** (1.91)
P_2	0.70$^{n.s}$ (0.76)	1.11$^{n.s}$ (1.58)	-0.75$^{n.s}$ (0.57)	-2.19** (0.50)	-1.68$^{n.s}$ (3.49)	0.31$^{n.s}$ (0.79)	-2.23$^{n.s}$ (2.22)	0.40$^{n.s}$ (0.80)	0.50$^{n.s}$ (1.53)	3.78$^{n.s}$ (4.42)
O	0.87$^{n.s}$ (0.48)	0.40$^{n.s}$ (0.48)	1.68** (0.36)	0.24$^{n.s}$ (0.32)	-3.47** (1.03)	1.26** (0.27)	-1.98* (0.87)	2.49** (0.74)	4.20* (1.71)	2.06$^{n.s}$ (1.65)
	Lahaul & Spiti									
P_1	-	-	-11.27* (4.58)	-18.98** (4.85)	-	-15.05** (4.26)	-	-14.02** (4.11)	-3.99$^{n.s}$ (2.00)	-
P_2	-	-1.33$^{n.s}$ (1.29)	-1.34$^{n.s}$ (1.31)	0.08$^{n.s}$ (2.85)	1.34$^{n.s}$ (5.71)	-0.73$^{n.s}$ (2.34)	-16.20$^{n.s}$ (10.03)	-6.99* (2.97)	-4.00** (0.80)	-2.89$^{n.s}$ (6.80)
O	-	[46]5.48** (1.57)	-1.16$^{n.s}$ (1.39)	-1.11$^{n.s}$ (1.98)	-	-1.01$^{n.s}$ (1.61)	-	-2.79$^{n.s}$ (1.59)	3.14** (0.93)	-
	Mandi									
P_1	0.01$^{n.s}$ (0.90)	0.39$^{n.s}$ (0.75)	0.47$^{n.s}$ (1.35)	-0.91$^{n.s}$ (0.79)	-2.16$^{n.s}$ (2.83)	0.50$^{n.s}$ (0.68)	-6.54** (1.89)	0.37$^{n.s}$ (0.69)	2.21$^{n.s}$ (1.42)	-6.04* (2.50)
P_2	2.45** (0.73)	2.72** (0.73)	0.64$^{n.s}$ (1.31)	0.59$^{n.s}$ (2.82)	-0.61$^{n.s}$ (3.48)	1.99** (0.59)	7.11** (1.81)	2.09** (0.59)	6.27* (2.13)	9.91** (2.19)
O	1.42** (0.30)	1.99** (0.28)	1.29** (0.46)	0.54$^{n.s}$ (0.75)	-2.85* (1.10)	1.81** (0.23)	0.46$^{n.s}$ (0.88)	1.84** (0.24)	5.62** (0.67)	3.27** (1.10)

[46] It is computed for the period 1978-79 to 2004-05.

Contd...

(per cent per annum)

Period	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Shimla									
P_1	$1.13^{n.s}$ (1.70)	$0.46^{n.s}$ (1.20)	$-0.77^{n.s}$ (1.30)	$-1.49^{n.s}$ (1.64)	-6.62** (1.53)	$-0.43^{n.s}$ (0.82)	-7.83** (2.02)	$-0.50^{n.s}$ (0.81)	-7.42** (1.81)	-8.15** (1.37)
P_2	$0.33^{n.s}$ (1.02)	$0.96^{n.s}$ (0.85)	$-2.32^{n.s}$ (1.24)	$-1.29^{n.s}$ (1.14)	$3.88^{n.s}$ (2.70)	$-0.003^{n.s}$ (0.728)	4.62* (2.05)	$-0.01^{n.s}$ (0.70)	$0.41^{n.s}$ (2.00)	6.02* (2.63)
O	$0.23^{n.s}$ (0.47)	1.10** (0.35)	$0.11^{n.s}$ (0.48)	$-0.62^{n.s}$ (0.48)	$-0.04^{n.s}$ (0.91)	0.71* (0.28)	$0.94^{n.s}$ (0.94)	0.56* (0.27)	3.52** (1.07)	4.51** (1.15)
	Sirmaur									
P_1	$2.64^{n.s}$ (2.10)	$0.48^{n.s}$ (1.09)	$-0.21^{n.s}$ (1.55)	$-3.14^{n.s}$ (2.03)	-3.70* (1.40)	$0.43^{n.s}$ (0.55)	-8.68** (1.59)	$0.44^{n.s}$ (0.54)	$-0.86^{n.s}$ (3.79)	-5.93** (1.75)
P_2	$0.32^{n.s}$ (1.12)	$0.53^{n.s}$ (0.80)	$-0.29^{n.s}$ (1.13)	$-1.08^{n.s}$ (1.17)	$1.22^{n.s}$ (2.84)	$0.31^{n.s}$ (0.68)	$-2.05^{n.s}$ (1.68)	$0.42^{n.s}$ (0.68)	$0.10^{n.s}$ (2.49)	$-0.30^{n.s}$ (1.58)
O	1.63** (0.56)	1.32** (0.33)	1.12* (0.48)	$0.44^{n.s}$ (0.63)	$0.56^{n.s}$ (0.85)	1.28** (0.24)	$-0.79^{n.s}$ (0.81)	1.35** (0.24)	7.83** (1.46)	$1.22^{n.s}$ (0.78)
	Solan									
P_1	$0.71^{n.s}$ (1.57)	$0.35^{n.s}$ (0.86)	$0.45^{n.s}$ (2.10)	$-3.93^{n.s}$ (2.19)	-	$0.40^{n.s}$ (0.80)	-14.00** (3.33)	$0.50^{n.s}$ (0.72)	-3.44* (1.42)	-13.20** (3.39)
P_2	3.40** (0.82)	$-0.44^{n.s}$ (0.57)	$0.99^{n.s}$ (1.39)	$-1.28^{n.s}$ (1.82)	-	$0.35^{n.s}$ (0.60)	$3.37^{n.s}$ (2.56)	$0.69^{n.s}$ (0.61)	$0.24^{n.s}$ (1.30)	5.77* (2.61)
O	2.60** (0.44)	0.84** (0.26)	2.41** (0.63)	$0.50^{n.s}$ (0.78)	-	1.42** (0.27)	$-1.55^{n.s}$ (1.39)	1.76** (0.26)	3.35** (0.73)	$-1.54^{n.s}$ (1.39)

Contd... *(per cent per annum)*

Period	Crops and Crop Groups									
	Rice	Maize	Wheat	Barley	Other Cereals	Total Cereals	Pulses	Foodgrains	Potato	Oilseeds
	Una									
P_1	-1.31$^{n.s}$ (1.26)	-0.32$^{n.s}$ (0.97)	-1.46$^{n.s}$ (1.35)	-	-	-0.92$^{n.s}$ (0.71)	-8.77** (1.89)	-0.37$^{n.s}$ (0.73)	-6.05$^{n.s}$ (4.11)	-5.50** (1.75)
P_2	2.48* (1.07)	2.82** (0.92)	2.05* (0.96)	-	-	2.38** (0.49)	2.68* (1.18)	2.52** (0.49)	2.97$^{n.s}$ (1.75)	8.99** (1.57)
O	3.55** (0.53)	1.34** (0.35)	2.37** (0.48)	-	-	1.82** (0.27)	-0.56$^{n.s}$ (0.79)	2.14** (0.27)	1.24$^{n.s}$ (1.20)	3.08** (0.88)

Note: (**) denotes significance at 1% probability level. (*) denotes significance at 5% probability level. (n.s) denotes non-significance at 5% probability level. Figures in brackets denote standard errors of growth rates.

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

4.3.4. Cropping Intensity

Land is one of the scarce resources, *inter alia,* in agricultural production which could be put to various alternative uses. In a scenario of dwindling land resource, crop intensification is one of the tools to augment scarce land resource so as to produce more output per unit of area and time. One of the ways to measure the intensity of land utilization is cropping intensity index. It implies how effectively the land is being utilized but does not consider the sustainability of land utilization. It is defined as the ratio of gross cropped area to net sown area and is usually multiplied by hundred to express it in per cent terms. Table 4.3.6 portrays district-wise cropping intensity in Himachal Pradesh during 1972-73 to 2007-08. By looking at the table it can be seen that cropping intensity in the state increased from 166.36 per cent in 1972-73 to 176.69 per cent in 2007-08 which showed an increase of about 10 per cent points during this period. The increase was, however, marginal over the years under consideration. As far as cropping intensity at the district level was concerned, it grew up in most of the districts but the trend was not uniform across the districts. Bilaspur experienced upward growth in cropping intensity from 174.59 per cent in 1972-73 to 187.86 per cent in 2007-08. It was the highest during 2000-01 (192.05%) but declined afterwards. Likewise, it increased in Chamba from 149.88 per cent in 1972-73 to 187.86 per cent in 2007-08. Similarly, Hamirpur recorded upwards growth from 177.92 per cent in 1972-73 to 194.10 per cent in 2007-08. It was the highest (197.26%) in 1990-91 but went down afterwards. Likewise, an increase in cropping intensity was witnessed in Kangra from 179.89 per cent in 1972-73 to 189.47 per cent in 2007-08 and it was the lowest in 1980-81. But, cropping intensity decreased in Kinnaur from 157.49 per cent to 116.12 per cent between 1972-73 and 2007-08. Nevertheless, it increased in Kullu from 139.76 per cent in 1972-73 to 176.64 per cent in 2007-08. Cropping intensity was observed to be almost stagnant i.e. 104.17 per cent to 104.78 per cent between 1972-73 and 2007-08 in Lahaul & Spiti. However, a downturn was seen between 1972-73 and 2000-01. In addition, cropping intensity grew up in Mandi from 169.93 in 1972-73 to 185.45 in 2007-08 while a decline was seen in 1990-91. But, it diminished in Shimla from 156.31 per cent to 131.06 per cent between 1972-73 and 2007-08. However, Sirmaur recorded upwards growth from 171.26 per cent to 187.35 per cent between 1972-73 and 2007-08. In the same fashion, cropping intensity increased in Solan from 153.27 per cent in 1972-73 to 170.73 per cent in 2007-08. Likewise, Una experienced increase in cropping intensity from 157.55 per cent to 193.30 per cent between 1972-73 and 2007-08.

Cropping intensity index declined substantially only in the two districts of Kinnaur (41% points) and Shimla (25% points) during the study. This decline in part, may be attributed to the shifting of area from foodgrains to commercial crops in these two districts. Cropping intensity index in Lahaul & Spiti remained stagnant at around 104 per cent because there is only a single crop season in this tribal district which remains snow capped during the winters. However, the increase in cropping intensity index was quite large (35 to 38 per cent points) in case of Chamba, Kullu and Una districts between 1972-73 and 2007-08.

Table 4.3.6 District-wise Cropping Intensity in Himachal Pradesh, 1972-73 to 2007-08.

(per cent)

Sr. No.	Districts	Cropping Intensity				
		1972-73	**1980-81**	**1990-91**	**2000-01**	**2007-08**
1	Bilaspur	174.59	189.21	184.26	192.05	187.86
2	Chamba	149.88	156.34	155.50	146.60	187.86
3	Hamirpur	177.92	182.65	197.26	191.67	194.10
4	Kangra	179.89	160.60	178.85	184.07	189.47
5	Kinnaur	157.49	123.81	119.74	123.68	116.12
6	Kullu	139.76	151.90	255.04	179.57	176.64
7	Lahaul & Spiti	104.17	103.33	103.23	102.86	104.78
8	Mandi	169.93	177.28	171.17	183.80	185.45
9	Shimla	156.31	150.56	146.47	129.66	131.06
10	Sirmaur	171.26	183.94	181.25	182.19	187.35
11	Solan	153.27	158.37	170.73	163.33	170.73
12	Una	157.55	165.28	152.61	172.25	193.30
Himachal Pradesh		**166.36**	**165.40**	**168.77**	**170.86**	**176.69**

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, and Statistical Outline of Himachal Pradesh, 2009-10, Department of Economics and Statistics, Shimla-9, Government of Himachal Pradesh.

The increase in cropping intensity index value of low hill districts (Hamirpur, Kangra and Bilaspur) as well as mid hill districts (Solan and Sirmaur) sharing border with plains ranged from 9 per cent points to 17 per cent points. Thus, it was evident that the trend of cropping intensity index values was not monotonically increasing or declining rather it was uneven across the districts over the different points of time considered. However, the highest value of cropping intensity index was registered by different districts. That is to say, Kangra, Bilaspur, Kullu, Bilaspur and Hamirpur were the districts that recorded the highest values of cropping intensity index during 1972-73, 1980-81, 1990-91, 2000-01 and 2007-08, respectively.

4.3.5. Diversification of Agriculture

The term diversification originated from the word "*diverge*" which means to move or extend in a different direction from a common point. In relation to agricultural development, it is probably one of the most frequently used terms in the last two decades or so. Traditionally, the term diversification was used more in the context of a subsistence kind of farming, wherein farmers grew many crops on their farms. Household level food security and risk were considered as the main motives behind agricultural diversification. In the recent decades, diversification is increasingly being used to describe increase in area under high value crops. The emphasis on high value cash crops emerged after the trade liberalization in agriculture during 1990s (Jha *et al.* 2009). Diversification in any particular region is said to be dependent upon the changing social, economic, technological, geographical and institutional structure of that region (De 2005).

The extent of crop diversification in Himachal Pradesh during 1972-73 to 2004-05 as measured by Herfindahl index has been displayed in table 4.3.7. It is clear from the table that agriculture in the state remained highly diversified over the years from 1972-73 to 2004-05 with marginal tendency towards specialization as denoted by the increasing values of Herfindahl index. This implied that farmers in the state are still growing several crops instead of specialization in a few crops. Small size of operational holdings and fear from risk might be, among others, the main restraints to specialization of agriculture in the state. However, analysis of Herfindahl indices over a period from 1972-73 to 2004-05 revealed that Bilaspur, Chamba, Hamirpur, Kangra, Kullu, Mandi, Solan and Una were the districts depicting a trend towards specialized agriculture at varying rates. The values of Herfindahl indices were, however, less than 0.5 for all the districts. On the contrary, Kinnaur, Lahaul

& Spiti, Shimla and Sirmaur witnessed tendency towards diversified agriculture at varying extents. The pace of specialization was observed to be the highest in Hamirpur and the lowest in Kullu during the study period. Likewise, the highest rate of diversification was recorded in Kinnaur and the lowest in Shimla over the study period. Low holding size and highly risky hill agriculture could be the factors hindering crop specialization in the state.

Table 4.3.7 Extent of Crop Diversification in Himachal Pradesh, 1972-73 to 2004-05.

Sr. No.	Districts	Herfindahl Indices (HI)				
		1972-73	1980-81	1990-91	2000-01	2004-05
1	Bilaspur	0.3051	0.3381	0.3882	0.4378	0.4375
2	Chamba	0.2673	0.2732	0.2930	0.2735	0.2989
3	Hamirpur	0.2573	0.3729	0.4358	0.4555	0.4569
4	Kangra	0.2488	0.2648	0.2843	0.2809	0.2902
5	Kinnaur	0.5529	0.4711	0.2882	0.2444	0.2226
6	Kullu	0.2320	0.2392	0.2286	0.2391	0.2412
7	Lahaul & Spiti	0.3756	0.3676	0.2593	0.3136	0.3046
8	Mandi	0.2469	0.2485	0.2784	0.2857	0.2822
9	Shimla	0.2013	0.1974	0.1743	0.1789	0.1935
10	Sirmaur	0.2550	0.2644	0.2621	0.2377	0.2304
11	Solan	0.2478	0.2539	0.2905	0.2906	0.2813
12	Una	0.2816	0.3374	0.3718	0.3775	0.3924
Himachal Pradesh		**0.2263**	**0.2491**	**0.2659**	**0.2596**	**0.2603**

Note: HI = 1 denotes complete specialization and HI = 0 denotes complete diversification.

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

Herfindahl index cannot explain the modern definition of agricultural diversification in terms of increase in area under high value crops. It is indeed a measure of concentration denoting how many crops are being grown by the farmers in a particular time. Accordingly, growing a few crops is regarded as specialization while sowing many crops is termed as diversification. Therefore, to capture diversification in terms of increase in acreage under high value crops, changing level of area under non-foodgrains was considered for the purpose. It was assumed that all crops which are not classified as

foodgrains are more remunerative crops. Table 4.3.8 portrays area under non-foodgrains in Himachal Pradesh from 1972-73 to 2004-05. By simply eyeballing the table it can be realized that area under non-foodgrains increased continuously in the state from 8.64 per cent of total cropped area in triennium ending 1974-75 to 14.81 per cent of that in triennium ending 2004-05 i.e. almost doubled. In absolute terms also the area put to non-foodgrains grew up from 79.28 thousand hectares in 1974-75 to 140.88 thousand hectares in 2004-05. An analysis of area under non-foodgrains at the district level showed that it increased at varying rates in most of the districts (nine) while a marginal decline was observed in Bilaspur, Hamirpur and Kangra. Specifically, area allotted to non-foodgrains as percentage of total cropped area in Bilaspur decreased from 3.29 per cent of total cropped area to 2.82 per cent of that between the triennium endings 1974-75 and 2004-05, but an increase was seen within the triennium endings 1974-75 and 1990-91. Besides, Chamba experienced upward growth in the per cent area put to crops other than foodgrains from 6.31 per cent to 8.84 per cent between 1974-75 and 2004-05 while a decline was evident after triennium ending 2000-01. But, Hamirpur demonstrated a continuous decline in share of area allocated to non-foodgrains from 1.49 per cent in 1974-75 to 1.10 per cent in 2004-05. Likewise, Kangra witnessed a negligible decline from 10.52 per cent to 8.78 per cent between 1974-75 and 1990-91 whereas it remained stagnant afterwards. However, per cent share of area under non-foodgrains grew up substantially in Kinnaur from 8.45 per cent in 1974-75 to 43 per cent in 2004-05 i.e. an increase of about five times. Similarly, a continuous increase in the share of area devoted to non-foodgrains was observed in Kullu from 6.87 per cent to 22.28 per cent between 1974-75 and 2004-05. Lahaul & Spiti too experienced upwards growth from 27.19 per cent in 1974-75 to 59.89 per cent in 2004-05. However, a decline was observed from 1990-91 onwards. Similarly, increase in per cent area allotted to non-foodgrains was evident in Mandi from 5.95 per cent to 10.12 per cent over the years between 1974-75 and 2004-05. Likewise, Shimla recorded a continuous increase from 17.09 per cent in 1974-75 to 50.27 per cent in 2004-05. Furthermore, area put to crops other than foodgrains grew up continuously in Sirmaur from 10.16 per cent in 1974-75 to 19.80 per cent in 2004-05. Solan traced an uneven trend but as a whole displayed a rise in area under non-foodgrains from 9.36 per cent to 13.94 per cent between 1974-75 and 2004-05. Lastly, the trend was not uniform in Una as well, but the area put under non-foodgrains, in its totality, went up slightly from 8 per cent to 9.12 per cent over time between 1974-75 and 2004-05.

To conclude from above, it is evident that diversification towards high value cash crops in most of the districts did take place during the study period but its intensity was quite pronounced in Kinnaur, Shimla, Lahaul & Spiti and Kullu where the increase in area under non-foodgrains was varying from 15.41 per cent points in Kullu to 34.55 per cent points in Kinnaur.

Table 4.3.8 Area Put to Non-foodgrains in Himachal Pradesh, 1972-73 to 2004-05.

('000 ha)

Sr. No.	Districts	Triennium Ending (TE)				
		1974-75	1980-81	1990-91	2000-01	2004-05
1	Bilaspur	1.78 (3.29)	1.68 (2.89)	2.15 (3.56)	1.77 (3.09)	1.62 (2.82)
2	Chamba	3.88 (6.31)	4.33 (6.82)	4.61 (7.12)	6.10 (9.45)	5.78 (8.84)
3	Hamirpur	1.07 (1.49)	0.99 (1.38)	0.64 (0.85)	0.80 (1.13)	0.77 (1.10)
4	Kangra	21.92 (10.52)	17.45 (8.84)	18.83 (8.78)	22.31 (10.14)	22.08 (10.14)
5	Kinnaur	0.99 (8.45)	1.16 (10.98)	2.26 (24.68)	3.52 (38.14)	3.78 (43.00)
6	Kullu	3.54 (6.87)	5.95 (11.33)	9.09 (15.51)	13.09 (21.19)	14.16 (22.28)
7	Lahaul & Spiti	0.71 (27.19)	1.62 (51.31)	2.10 (64.00)	1.93 (55.47)	2.01 (59.89)
8	Mandi	8.532 (5.95)	11.352 (7.11)	12.243 (7.47)	14.503 (9.08)	16.154 (10.12)
9	Shimla	17.90 (17.09)	20.77 (19.58)	31.51 (28.96)	43.28 (43.56)	47.51 (50.27)
10	Sirmaur	7.59 (10.16)	8.55 (10.89)	9.50 (12.20)	13.76 (17.76)	14.74 (19.80)
11	Solan	6.39 (9.36)	5.76 (8.30)	7.36 (10.63)	9.05 (14.00)	8.85 (13.94)
12	Una	5.21 (8.00)	5.51 (7.79)	6.53 (9.02)	6.12 (8.70)	6.62 (9.12)
Himachal Pradesh		**79.28 (8.64)**	**84.17 (8.95)**	**106.02 (10.83)**	**131.63 (13.74)**	**140.88 (14.81)**

Note: Figures in brackets are percentages (as per cent of total cropped area).

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

4.4. Irrigation Status

Himachal Pradesh has high ranges of the Himalayas, some of which contain perennial glaciers and snow-capped peaks. These supply water throughout the year to various rivers that pass through the state. Despite the fact that, there is plenty of water in the hills, water use for irrigation was confined to about 1.04 *lakh* hectares out of nearly 5.43 *lakh* hectares of cultivated land in 2004-05. More than 50,000 hectares of cultivated land can be brought under irrigation facilities through major and medium irrigation projects and the remaining area can be provided with irrigation through minor and other irrigation schemes (HPDR 2005). This section describes the irrigation extent and intensity of irrigation both at the state as well as district levels.

4.4.1. Irrigation Extent

Irrigation is one of the essential inputs, *inter alia,* in crop production. Availability of water is one of the basic factors that enables bringing of land under cultivation and makes it suitable for farming. Rainfed agriculture accounts for a major part of agricultural land in Himachal Pradesh. The availability of irrigation water is a major limiting factor to agricultural development particularly in the hilly regions where the harsh terrains restrain the extension of land under irrigation. Irrigation extent measures that part of cultivated land which receives irrigation. Table 4.4.1 depicts irrigation extent in Himachal Pradesh from 1972-73 to 2004-05. It can be easily inferred from the table that irrigation extent increased marginally in the state from 16.83 per cent of net sown area to 19.15 per cent of that between the triennium endings 1974-75 and 2004-05. As far as analysis of irrigation extent at districts level was concerned, it witnessed perceptible increase in Kinnaur, Una, Solan, and Sirmaur districts ranging from about 8.45 per cent points to 33.21 per cent points during the study period. Since these districts border the plains, it might be attributed to the exploitation of ground water resources in these areas through tube wells. There appeared to be a decline of varying magnitudes in irrigation extent in the districts that have *kuhl* irrigation as major source of irrigation (Shimla, Kangra and Kullu) during this period. It might be attributed to the drying up of perennial springs sources in these areas partly due to changing climate and partly due to haphazard construction and gradual disappearance of institutions looking after these *kuhls*. In Lahaul & Spiti irrigation extent remained almost hundred per cent over the period of study which meant the entire cultivated land was subject to irrigation. It could be attributed to the geographical location of the district which

remains under snow for about six months in a year and is fed by glacial waters during summers in the form of *kuhls*.

Table 4.4.1 Irrigation Extent in Himachal Pradesh, 1972-73 to 2004-05. ('000 ha)

Districts	Years	Net Sown Area (NSA)	Net Irrigated Area (NIA)	Irrigation Extent (per cent to NSA)
1. Bilaspur	1972-73	30.70	1.99	6.50
	1990-91	32.40	2.89	8.92
	2004-05	30.20	3.16	10.46
2. Chamba	1972-73	40.10	3.99	9.95
	1990-91	41.80	5.28	12.63
	2004-05	41.90	5.67	13.54
3. Hamirpur	1972-73	39.40	1.50	3.80
	1990-91	40.20	1.77	4.39
	2004-05	35.50	1.71	4.81
4. Kangra	1972-73	125.30	38.93	31.07
	1990-91	120.10	32.51	27.07
	2004-05	117.20	35.07	29.92
5. Kinnaur	1972-73	32.70	2.23	6.81
	1990-91	7.60	4.22	55.55
	2004-05	7.50	4.48	59.76
6. Kullu	1972-73	8.30	4.26	51.30
	1990-91	23.80	2.12	8.90
	2004-05	36.20	2.81	7.77
7. Lahaul & Spiti	1972-73	2.40	2.40	100.00
	1990-91	3.14	3.14	100.00
	2004-05	3.30	3.29	99.76
8. Mandi	1972-73	85.80	13.46	15.68
	1990-91	95.40	13.50	14.15
	2004-05	85.60	13.77	16.09
9. Shimla	1972-73	66.60	4.46	6.70
	1990-91	75.10	4.49	5.97
	2004-05	67.90	2.33	3.43
10. Sirmaur	1972-73	42.80	11.05	25.82
	1990-91	43.20	14.52	33.61
	2004-05	41.20	14.12	34.27
11. Solan	1972-73	42.80	7.13	16.65
	1990-91	41.00	9.43	23.00
	2004-05	39.40	9.96	25.28
12. Una	1972-73	41.70	1.72	4.12
	1990-91	46.00	5.60	12.17
	2004-05	36.80	8.06	21.91
Himachal Pradesh	**1974-75**	**552.93**	**93.07**	**16.83**
	1990-91	**582.80**	**99.46**	**17.07**
	2004-05	**542.60**	**103.93**	**19.15**

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, and Statistical Outline of Himachal Pradesh (various issues), Department of Economics and Statistics, Shimla-9, Government of Himachal Pradesh.

Contrary to this, irrigation extent was the lowest in Hamirpur during the study period where only 3.80 per cent of its cultivated land was eligible for irrigation in 1972-73 which grew up marginally to 4.81 per cent of that in 2004-05.

4.4.2. Irrigation Intensity

Irrigation water is one of the scarce inputs in the farm economy. Thus, farmers have to use it in an efficient way and take the maximum advantage out of it. It is because of this that new irrigation systems and better practices are invented to help farmers in improving water management on their farms. Different methods are used to capture the efficiency of utilizing water resources. Irrigation intensity is mainly used to measure the intensity of water utilization in agriculture which in turn implies efficiency of using the water resource. It is defined as the ratio of gross irrigated area to net irrigated area expressed in per cent terms. Table 4.4.2 depicts district-wise irrigation intensity in Himachal Pradesh from 1972-73 to 2004-05. It can be observed in this table that irrigation intensity came down in the state from 174.46 per cent to 144.44 per cent between 1972-73 and 2000-01 but it returned almost to its initial level in 2004-05. As regards the irrigation intensity at the district level, while it went up in most of the districts (eight), it declined in Chamba, Kullu, Mandi and Kangra during the study period. However, the trends traced over the period of study were full of ups and downs within as well as among the districts. As a whole Bilaspur experienced an increase in irrigation intensity from 183.35 per cent in 1972-73 to 193.74 per cent in 2004-05 while a decline was observed in Chamba from 185.26 per cent to 120.48 per cent between 1972-73 and 2004-05. Moreover, irrigation intensity grew up in Hamirpur from 166.73 per cent to 198.36 per cent in 2004-05 whereas it decreased in Kangra from 193.21 per cent to 188.01 per cent over the same period. Besides, Kinnaur witnessed a slight increase in irrigation intensity from 121.42 per cent to 125.55 per cent over time between 1972-73 and 2004-05. But it declined in Kullu from 145.98 per cent in 1972-73 to 102.38 per cent in 2004-05. Similarly, a marginal rise in irrigation intensity was experienced in Lahaul & Spiti from 104.16 per cent to 105.98 per cent between 1972-73 and 2004-05 whereas it decreased in Mandi from 192.50 per cent in 1972-73 to 183.24 per cent in 2004-05. Additionally, irrigation intensity increased in Shimla, Sirmaur, Solan and Una, respectively from 171.15 per cent to 180.54 per cent, 173.26 per cent to 188.50 per cent, 143.79 per cent to 184.39 per cent and 113.66 per cent to 176.80 per cent, between 1972-73 and 2004-05. However, the highest degree of irrigation intensity was recorded in Kangra (193.21%), Chamba (194.47%), Kangra (191.00%), Mandi (193.82%) and

Hamirpur (198.36%) during 1972-73, 1980-81, 1990-91, 2000-01 and 2004-05, in that order. Contrary to this, the lowest level of irrigation intensity was registered in Kullu and Lahaul & Spiti (in the range of 100% to 104.16%) over all the points of time considered.

In a nutshell, irrigation intensity increased in most of the districts. It recorded a very high increase in Una (64 per cent points), Solan (40 per cent points), Hamirpur (21 per cent points) and Sirmaur (15 per cent points) whereas the decline in irrigation intensity was very severe in Chamba (65 per cent points), Kullu (44 per cent points) and Mandi (10 per cent points) during the period of study.

Table 4.4.2 Irrigation Intensity in Himachal Pradesh, 1972-73 to 2004-05. ***(per cent)***

Sr. No.	Districts	Irrigation Intensity				
		1972-73	1980-81	1990-91	2000-01	2004-05
1	Bilaspur	183.35	193.88	188.30	179.46	193.74
2	Chamba	185.26	194.47	120.46	118.26	120.48
3	Hamirpur	166.73	191.56	183.07	183.99	198.36
4	Kangra	193.21	186.14	191.00	116.99	188.01
5	Kinnaur	121.42	148.90	121.60	128.64	125.55
6	Kullu	145.98	100.00	100.00	115.74	102.38
7	Lahaul & Spiti	104.16	104.56	102.42	103.10	105.98
8	Mandi	192.50	168.74	174.90	193.82	183.24
9	Shimla	171.15	158.92	160.11	173.93	180.54
10	Sirmaur	173.26	185.48	173.64	182.10	188.50
11	Solan	143.79	136.26	167.75	186.40	184.39
12	Una	113.66	132.83	131.70	156.57	176.80
Himachal Pradesh		**174.46**	**169.76**	**167.70**	**144.44**	**175.18**

Source: Computed from the data taken from the Annual Season and Crop Report (various issues), Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

4.5. Input Use in Hill Agriculture

As we know production is a process through which inputs get transformed into output. So without inputs no production is expected. Agriculture being no exception, a set of various inputs i.e. land, water, seeds, fertilizers, pesticides, man power, machines, bullock power, etc. are combined together to produce a particular agricultural product. However, some of the inputs are essential for production in the absence of which no production is possible while some others either facilitate or accelerate the production process or make it more effective. Use of the modern inputs is much higher in commercial agriculture but farmers in many less-developed countries have continued using the conventional inputs and family labour. Nevertheless, agriculture creates market for farm as well as non-farm inputs and transfers resources (capital or labour) to other sectors, thus making factor contribution to rest of the economy. Although, the major inputs i.e. land and water were discussed in the preceding sections, this section is devoted to examine the status of some other important farm inputs i.e. fertilizers, high yielding varieties (HYVs) seeds and mechanization in the state.

4.5.1. Trends in Fertilizers Consumption

Fertilizer is one of the most critical farm inputs that have brought about substantial improvement, *inter alia*, in agricultural productivity. It was amply reflected as the most important component of the Green Revolution technology after improved seed varieties. Conventionally, the small farmers have been using farmyard manure (FYM) as the main nutrient supplier, but of late certain efforts have been made to popularize the use of chemical fertilizers in the state (HPDR 2005). Table 4.5.1 explains district-wise fertilizers consumption in Himachal Pradesh for a period from 1990-91 to 2008-09. By just eyeballing the table, it can be easily conceived that fertilizers consumption in the state increased continuously from 34.91 kilogram per hectare of gross cropped area (kg/ha) in triennium ending 1992-93 to 55.87 kg/ha in triennium ending 2008-09 which showed an increase of 60 per cent during this period. Juxtaposing the composition of actual fertilizer consumption of nitrogen (N), phosphorus (P) and potassium (K) to the ideal ratio of N:P:K (4:2:1) at the state level it was found in favour of nitrogen (N), but against phosphorus (P) between the triennium endings 1992-93 and 2000-01. While the imbalance in nitrogen was almost corrected by 2008-09, the same with respect to phosphorus worsened further.

An analysis of the trends in fertilizers consumption at the district level revealed that it grew up continuously at varying rates in most of the districts (ten) while it almost remained static in Bilaspur and Lahaul & Spiti but increased marginally in Hamirpur overtime between 1992-93 and 2008-09. Specifically, fertilizers consumption increased in Chamba from 12.09 kg/ha in 1992-93 to 20.88 kg/ha in 2008-09. The desired ratio was favouring nitrogen but it was below that for phosphorus during the same time range. An upward growth in fertilizers consumption was also witnessed in Kangra from 31.48 kg/ha in 1992-93 to 44.22 kg/ha in 2008-09. The desired ratio was more in favour of nitrogen over the period of study but phosphorus was up to the requirement in 2000-01. Fertilizers consumption grew up in Kinnaur from 13.58 kg/ha to 24.09 kg/ha overtime between 1992-93 and 2008-09. The ideal ratio was, however, not up to the required level for both nitrogen and phosphorus during the same period. Similarly, Kullu experienced a very high upward growth in fertilizer consumption (94 per cent) from 31.64 kg/ha to 61.50 kg/ha between 1992-93 and 2008-09 i.e. almost doubled. The wanted ratio was changed, for one reason or another, against both nitrogen and phosphorus. Moreover, a decrease in fertilizers consumption was witnessed in Lahaul & Spiti from 114.63 kg/ha to 73.67 kg/ha between 1992-93 and 2000-01 but it increased to 112.32 kg/ha by 2008-09. The desired ratio remained quite below the required rate for both nitrogen and phosphorus over the same time period. Fertilizer consumption grew up in Mandi from 29.38 kg/ha in 1992-93 to 40.65 kg/ha in 2008-09. Over the same period, the ideal ratio changed in favour of nitrogen while it was down the needed level for phosphorus. Likewise, Shimla demonstrated the highest increase in fertilizers consumption (175 per cent) from 42.98 kg/ha in 1992-93 to 118.30 kg/ha in 2008-09. Share of potassium remained dominant in the desired ratio but nitrogen and phosphorus were below the desired level. This huge increase in fertilizer consumption in Shimla in general and potassium in particular could be attributed to the growing of fruit, especially apple, and vegetable crops in this district. Fertilizers consumption increased in Sirmaur from 27.14 kg/ha to 44.35 kg/ha overtime between 1992-93 and 2008-09. The ideal ratio was more in favour of nitrogen while it remained against phosphorus. Besides, Solan depicted remarkable increase in fertilizer consumption from 41.14 kg/ha in 1992-93 to 65.75 kg/ha in 2008-09. The desired ratio changed in favour of both nitrogen and phosphorus over time from 1992-93 and 2000-01 but was benefiting nitrogen alone in 2008-09.

Table 4.5.1 District-wise Fertilizers Consumption in Himachal Pradesh, 1990-91 to 2008-09. ***(kg/ha of gross cropped area)***

Sr. No.	Districts	Triennium Ending (TE)	Fertilizers Consumption			
			N	P	K	Total
1	Bilaspur	1992-93	32.30	3.40	1.58	37.28
		2000-01	31.16	3.66	1.83	36.65
		2008-09	29.63	3.95	2.70	36.28
2	Chamba	1992-93	10.13	1.10	0.86	12.09
		2000-01	13.76	0.72	0.55	15.04
		2008-09	17.84	1.82	1.22	20.88
3	Hamirpur	1992-93	31.41	2.16	1.47	35.05
		2000-01	30.26	2.95	1.41	34.63
		2008-09	33.00	3.95	2.62	39.56
4	Kangra	1992-93	24.59	4.36	2.52	31.48
		2000-01	27.55	6.38	3.13	37.07
		2008-09	31.97	7.43	4.81	44.22
5	Kinnaur	1992-93	6.62	3.74	3.22	13.58
		2000-01	8.98	2.81	2.74	14.54
		2008-09	10.05	7.42	6.63	24.09
6	Kullu	1992-93	18.04	6.67	6.93	31.64
		2000-01	18.23	4.51	6.12	28.87
		2008-09	29.03	15.12	17.35	61.50
7	Lahaul & Spiti	1992-93	46.19	41.65	26.79	114.63
		2000-01	32.19	25.67	15.81	73.67
		2008-09	42.72	40.33	29.27	112.32
8	Mandi	1992-93	22.49	3.80	3.09	29.38
		2000-01	25.40	4.67	2.89	32.96
		2008-09	28.41	6.87	5.37	40.65
9	Shimla	1992-93	20.09	11.88	11.01	42.98
		2000-01	25.11	13.06	16.89	55.06
		2008-09	40.86	32.35	45.09	118.30
10	Sirmaur	1992-93	21.36	3.85	1.93	27.14
		2000-01	26.47	5.05	2.65	34.17
		2008-09	32.62	7.25	4.48	44.35
11	Solan	1992-93	32.60	6.20	2.35	41.14
		2000-01	36.77	6.64	3.28	46.69
		2008-09	47.36	11.26	7.13	65.75
12	Una	1992-93	43.53	7.61	3.06	54.20
		2000-01	55.26	10.16	4.48	69.89
		2008-09	68.02	17.05	11.29	96.36
Himachal Pradesh		**1992-93**	**26.02**	**5.24**	**3.65**	**34.91**
		2000-01	**28.23**	**6.10**	**4.45**	**38.77**
		2008-09	**35.24**	**10.67**	**9.96**	**55.87**

Source: Computed from the data taken from Fertilizer Statistics (various issues), The Fertilizer Association of India, New Delhi, Annual Season and Crop Report (various issues), Directorate of Land Record, and Statistical Outline of Himachal Pradesh (various issues), Department of Economics & Statistics, Shimla-9, Government of Himachal Pradesh.

However, Una experienced considerable rise in fertilizers consumption (78 per cent) from 54.20 kg/ha to 96.36 kg/ha between 1992-93 and 2008-09. Its desired ratio was favouring nitrogen and phosphorus over time from 1992-93 to 2000-01 whereas it was benefiting only nitrogen in 2008-09. For better understanding, the trends in fertilizers consumption across the districts are also presented graphically in the *appendix 5*.

Broadly speaking, fertilizers consumption was the highest in Lahaul & Spiti (114.63 kg/ha) while it was the lowest in Chamba (12.09 kg/ha) over the triennium ending 1992-93. However, Lahaul & Spiti registered the largest level of fertilizers consumption (73.67 kg/ha) but the lowest level was recorded in Kinnaur (14.54 kg/ha) during the triennium ending 2000-01. Nevertheless, Shimla replaced Lahaul & Spiti by securing the highest level of fertilizers consumption (118.30 kg/ha) but Chamba substituted Kinnaur by recording the lowest fertilizers consumption (20.88 kg/ha) in the triennium ending 2008-09. Furthermore, the increase in fertilizer consumption was observed to be the highest in Shimla (175 per cent), Kullu (94 per cent) and Una (78 per cent) while the lowest rate of increase was witnessed in Hamirpur (13 per cent) during the study period. The ideal ratio of fertilizers consumption changed in most of the districts (eight) in favour of nitrogen while it was benefiting neither nitrogen nor phosphorus in the remaining four districts. The inter-district variations in fertilizer consumption were quite glaring as evinced by almost 5-6 times higher consumption in Shimla, Lahaul & Spiti and Una as against Chamba with the lowest consumption in the state during 2008-09. Again seven districts had per hectare consumption that was lower than state level consumption of 55.87 kg/ha in 2008-09.

4.5.2. Trends in Area under High Yielding Varieties

Seed is the most important determinant of agricultural potential on which the efficiency of other agricultural inputs depends. Seeds of appropriate characteristics, variety, quality and certification are required to meet the demand of diverse agro-climatic conditions and cropping pattern. Himachal Pradesh has no well-defined seed production programmes as there is no Seed Corporation and private seed organizations are not ready to help the state in seed production/distribution programmes. Thus, the state relies greatly on seeds produced by local farmers, which is rather insufficient and without any quality determinants. However, certified seeds of high yielding varieties procured by the state for different crops, including vegetables, are distributed to the farmers (HPDR 2005). High

yielding varieties (HYVs) seeds have been one of the main determinants of increased agricultural productivity. These ushered in a revolution in 1960s popularly known as Green Revolution, which has brought about a paradigm shift in food self-sufficiency in the country. Table 4.5.2 portrays area under high yielding varieties of major cereals in Himachal Pradesh overtime from 1974-75 to 2009-10. A cursory look at the table brings out that area under high yielding varieties of wheat increased from 212.94 thousand hectares (63.94% of total area under wheat) to 342.61thousand hectares (94.53% of total area under wheat) between the triennium endings 1976-77 and 2007-08. It declined to 328.44 thousand hectares in triennium ending 2009-10.

Table 4.5.2 Area under High-Yielding Varieties of Major Cereals in Himachal Pradesh, 1974-75 to 2009-10. **('000 ha)**

Triennium Ending (TE)	Wheat	Maize	Rice
1976-77	212.94 (63.94)	55.53 (20.83)	51.22 (53.62)
1980-81	256.32 (74.52)	66.98 (23.99)	76.20 (81.26)
1990-91	337.33 (90.34)	91.30 (28.90)	-
2000-01	209.65 (56.51)	157.75 (52.65)	39.24 (48.28)
2007-08	342.61 (94.53)	278.02 (93.24)	72.37 (95.58)
2009-10*	328.44	285.77	75.37

Note: Figures in brackets are percentages of area under high yielding varieties of the respective crops to the total area they have covered. *For the TE 2009-10 data on area under these crops was not available therefore only the area under HYVs of these crops is given without percentages.
Source: Computed from the data taken from Statistical Outline of Himachal Pradesh (various issues) Department of Economics & Statistics, and Annual Season and Crop Report (various issues) Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

Moreover, area under high yielding varieties of maize increased continuously from 55.53 thousand hectares (20.83% of total area under maize) in 1976-77 to 278.02 thousand hectares (93.24% of total area under maize) in 2007-08 and it further increased to 285.77 thousand hectares in 2009-10. Besides, area under high yielding varieties of rice increased from 51.22 thousand hectares (53.62% of total area under rice) to 72.37 thousand hectares (95.58% of total area under rice) between 1976-77 and 2007-08 which grew up further to 75.37 thousand hectares in 2009-10. A decrease to 39.24 thousand hectares (48.28% of total area under rice) was, however, evident during 2000-01. In short, area under high yielding varieties of wheat, maize and paddy grew up substantially in the state both in

absolute and per cent terms during the study period. The per cent area under high yielding varieties of wheat, maize and rice was the highest for wheat followed by rice and maize in 1976-77 whereas it was largest for rice followed by wheat and maize in 2007-08.

4.5.3. Extent of Mechanization

Agricultural mechanization implies the use of various power sources and improved farm tools and equipments, with a view to reduce the drudgery of the human beings and draught animals, enhance the cropping intensity, precision and efficiency of utilization of various crop inputs and reduce the losses at various stages of crops production. The end objective of farm mechanization is to enhance the overall productivity and production with the lowest cost of production. However, contribution of agricultural mechanization has been well recognized in improving the production together with irrigation, biological and chemical inputs of high yielding seed varieties, fertilizers, pesticides and mechanical energy (Verma 2006). Farm mechanization in Himachal Pradesh is confined to the southwest submontane regions where land is mostly flat and less undulated. In the hilly terrain, small tractors, power tillers and power sprayers are made available to farmers on subsidy but mechanization is rather meagre and only some big orchardists use these implements. Special small instruments to meet the needs of hill farming have to be developed and popularized (HPDR 2005). Table 4.5.3 delineates the extent of mechanization in Himachal Pradesh during 1972-73 to 2003-04. It is obvious from the table that the extent of mechanization in terms of the number of agricultural implements per one thousand hectares of gross cropped area, increased continuously from 1.543 machines per one thousand hectare of gross cropped area to 39.278 of that during the period of study.

Table 4.5.3 Extent of Mechanization in Himachal Pradesh, 1972-73 to 2003-04.

Agricultural Census	Agricultural Implements (numbers)				Total	Extent of Mechanization (Machines per '000 ha of Goss Cropped Area)
	Tractors	Threshers	Electric Pumps	Oil Engines		
1972-73	402	439	338	255	1434	1.543
1982-83	936	8847	585	1177	11545	12.053
1992-93	3466	19221	1222	1299	25208	25.918
1997-98	4205	14048	2530	1295	22078	22.384
2003-04	6966	19458	7325	3664	37413	39.278

Source: Computed from the data taken from Statistical Outline of Himachal Pradesh (various issues), Department of Economics & Statistics and Annual Season and Crop Report, Directorate of Land Records, Shimla-9, Government of Himachal Pradesh.

More specifically, the number of tractors grew up significantly from 402 to 6966 between 1972-73 and 2003-04. During the same period, a considerable increase was also observed in the number of threshers from 439 to 19458. The number of electrical pumps in use went up remarkably from 338 to 7325. Similarly, the number of oil engines in use increased conspicuously from 225 to 3664.

4.6. Employment in Agriculture

Agriculture is the main source of livelihood for the masses of people in developing countries including India. Over 90 per cent of population in Himachal Pradesh lives in rural areas most of which sustains on agriculture as main source of livelihood. As a natural consequence of development process, the share of agriculture in the total employment decreases due to growth in manufacturing and services sectors. In such a situation agriculture makes factor contribution by providing its surplus labour to other sectors of the economy. Modern agriculture sector though reduces on-farm employment but creates indirect employment in industries producing agricultural inputs and implements or provide services to the agriculture sector. Hence, in this section trends in agricultural employment and agricultural work participation rates have been examined and discussed both at the state as well as district level so as to provide a clear-cut picture of agricultural employment in the state.

4.6.1. Trends in Agricultural Employment

Population censuses provide useful classification of various kinds of workers. Using this information, the sum of cultivators and agricultural labourers was used to determine employment in the agriculture sector of the state. Table 4.6.1 displays district-wise workers engaged in agriculture in Himachal Pradesh during 1981 to 2001. It can be seen from the table that workers engaged in agriculture in the state declined marginally from 70.80 per cent to 68.65 per cent between 1981 and 2001. As far as male and female workers were concerned, the former declined substantially from 63.29 per cent in 1981 to 52.85 per cent in 2001 whereas the latter declined negligibly from 91.28 per cent to 88.64 per cent between 1981 and 1991 but it increased to 89.03 per cent during 2001.

Analysis of trends in agricultural employment at the district level provided a mixed picture. Bilaspur witnessed a decline in per cent share of workers engaged in agriculture from 76.24 per cent of total workers to 70.49 per cent of that between 1981 and 2001. During the same period, percentage of agricultural labourers decreased in Kullu from 82.28

per cent to 78.78 per cent. Mandi also depicted a continuous decline in the share of workers engaged in agriculture from 77.75 per cent to 74.09 per cent. Likewise, the share of workers involved in agriculture declined in Shimla from 69.65 per cent to 67.16 per cent. The per cent share of workers engaged in agriculture diminished marginally in Sirmaur from 75.22 per cent to 74.18 per cent. Similarly, Solan witnessed decline in the share of workers active in agriculture form 67.87 per cent to 57.06 per cent. Percentage of workers involved in agriculture decreased in Una from 67.02 per cent to 62.82 per cent. Contrarily, Chamba experienced increase in per cent share of workers engaged in agriculture from 69.30 per cent to 73.79 per cent between 1981 and 2001. Over the same period, percentage of workers working in agriculture increased in Kangra from 61.63 per cent to 63.64 per cent. Kinnaur also witnessed an increase in work force engaged in agriculture from 67.28 per cent 68.87 per cent. Besides, workers engaged in agriculture as percentage of total workers grew up in Lahaul & Spiti from 52.77 per cent to 54.68 per cent. However, the share of workers engaged in agriculture remained almost stagnant in Hamirpur during the study period.

As regards the per cent share of male agricultural workers in total workers, except Kinnaur where it increased (4.16 per cent points), all the remaining districts witnessed a downturn during the study period. The decline was substantial in Solan (21.61 per cent points), Una (19.09 per cent points), Bilaspur (17.16 per cent points), Hamirpur (13.13 per cent points), Mandi (10.79 per cent points) and Kangra (10.15 per cent points). Moreover, the share of female agricultural workers as percentage of total workers grew up in Una (9.96 per cent points), Kangra (2.63 per cent points), Chamba (2.33 per cent points) and Lahaul & Spiti (1.82 per cent points) while it declined in rest of the districts. But the decrease was very high in Shimla (4.84 per cent points), Kinnaur (4.14 per cent points), Mandi (3.24 per cent points) and Kullu (3.20 per cent points). It can, thus, be concluded that the decline in the share of male agricultural labourers was higher than that of females in all the districts and state during the study period.

Thus, it is evident from above that workers engaged in agriculture as percentage of total workers increased in Chamba, Kangra, Kinnaur and Lahaul & Spiti while rest of the districts experienced decline in the share of workers involved in agriculture during the study period. However, it remained almost constant in Hamirpur. The share of male agricultural labourers, except in Kinnaur, decreased in all the districts.

Table 4.6.1 Workers Engaged in Agriculture in Himachal Pradesh, 1981 to 2001.

Sr. No.	Districts	Population Census	Workers Category		
			Male (%)	Female (%)	Persons (%)
1	Bilaspur	1981	68.45	95.61	76.24
		1991	64.44	92.59	72.14
		2001	51.29	92.73	70.49
2	Chamba	1981	65.02	87.88	69.30
		1991	65.42	82.95	68.83
		2001	60.36	90.21	73.79
3	Hamirpur	1981	61.67	94.36	71.18
		1991	54.98	92.96	68.77
		2001	48.54	93.42	71.58
4	Kangra	1981	57.20	82.95	61.63
		1991	57.77	81.40	62.85
		2001	47.05	85.57	63.64
5	Kinnaur	1981	50.75	91.93	67.28
		1991	46.33	87.74	60.31
		2001	54.91	87.79	68.87
6	Kullu	1981	75.56	94.62	82.28
		1991	74.40	93.47	81.12
		2001	68.49	91.42	78.78
7	Lahaul & Spiti	1981	39.16	76.21	52.77
		1991	43.23	84.28	58.16
		2001	38.92	78.03	54.68
8	Mandi	1981	68.10	95.41	77.75
		1991	67.10	93.39	77.22
		2001	57.31	92.17	74.09
9	Shimla	1981	57.74	91.83	69.65
		1991	52.30	86.17	64.09
		2001	53.46	86.99	67.16
10	Sirmaur	1981	70.14	92.74	75.22
		1991	68.70	92.84	75.74
		2001	62.72	91.56	74.18
11	Solan	1981	62.10	87.34	67.87
		1991	50.90	83.02	58.11
		2001	40.49	85.00	57.06
12	Una	1981	66.32	75.26	67.02
		1991	60.83	78.93	63.38
		2001	47.23	85.22	62.82
Himachal Pradesh		**1981**	**63.29**	**91.28**	**70.80**
		1991	**60.55**	**88.64**	**68.71**
		2001	**52.85**	**89.03**	**68.65**

Note: Percentages are computed for each category from their respective totals.

Source: Computed from the data taken from Primary Census Abstract, Census of India, 1981, 1991, 2001.

In relation to the per cent share of female agricultural workers, it grew up in Chamba, Kangra, Lahaul & Spiti, and Una while it decreased in rest of the districts. However, the highest share of workers engaged in agriculture was observed in Kullu while the lowest was seen in Lahaul & Spiti. In a nutshell, there was a decline in per cent share of workers engaged in agriculture during the study period (1981-2001) in Solan, Bilaspur, Una, Mandi, Kullu, Shimla and Sirmaur districts which could be attributed to the growing industrialization in these districts. It was quite pronounced in Solan (10.81 per cent points), Bilaspur (5.75 per cent points) and Una (4.20 per cent points) districts that border plains. On the contrary, there was an increase in the per cent share of workers involved in agriculture in Chamba, Kangra, Lahaul & Spiti and Kinnaur districts, being the highest in Chamba (4.49 per cent points). But it remained almost stagnant in Hamirpur.

4.6.2. Agricultural Work Participation Rate (AWPR)

Workers engaged in agriculture were discussed in the preceding section. It is also often of interest to know what per cent of total population is involved in farming. In other words, workers engaged in agriculture constitute what per cent of total population. This was captured by computing agricultural work participation rates. Table 4.6.2 shows district-wise agricultural work participation rates in Himachal Pradesh for the period from 1981 to 2001. The table shows that per cent of population engaged in agriculture (AWPR) in the state increased from 24.33 per cent of total population to 33.71 per cent of that between 1981 and 2001 while a small decline to 22.90 per cent was observed during 1981 to 1991. In relation to the agricultural work participation rate of male population, it declined from 31.38 per cent of total population to 28.82 per cent while that for females increased continuously from 17.08 per cent to 38.77 per cent between 1981 and 2001.

The district level analysis of agricultural work participation rates revealed that it grew up at varying rates in all the districts over the study period from 1981 to 2001, but a decline was, however, evident in most of the districts during 1981 to 1991. More specifically, agricultural work participation rate went up in Bilaspur from 24.24 per cent to 34.37 per cent between 1981 and 2001. Likewise, workers engaged in agriculture as percentage of total population grew up in Chamba from 24.34 per cent in 1981 to 36.72 per cent in 2001 with a decline to 22.09 per cent in 1991. A continuous increase in agricultural work participation rate was witnessed in Hamirpur from 17.59 per cent in 1981 to 35.58 per cent in 2001. Similarly, Kangra experienced upward growth in the per cent share of

population engaged in agriculture from 16.44 per cent to 28.00 per cent between 1981 and 2001. Percentage of workers engaged in agriculture to total population in Kinnaur though declined to 28.21 per cent in 1991, it increased from 36.78 per cent to 40.95 per cent between 1981 and 2001. Besides, agricultural work participation rate increased in Kullu from 37.10 per cent to 44.61 per cent overtime between 1981 and 2001. Lahaul & Spiti also demonstrated a rise in per cent share of workers involved in agriculture out of total population (AWPR) from 31.18 per cent to 34.61 per cent between 1981 and 2001. Moreover, workers engaged in agriculture as percentage of total population (AWPR) grew up in Mandi from 29.10 per cent in 1981 to 37.28 per cent in 2001.

Table 4.6.2 District-wise Agricultural Work Participation Rates (AWPR) in Himachal Pradesh, 1981 to 2001. ***(per cent to total population)***

Sr. No.	District		Population Census		
			1981	1991	2001
1	Bilaspur		24.24	21.43	34.37
2	Chamba		24.34	22.09	36.72
3	Hamirpur		17.59	18.92	35.58
4	Kangra		16.44	16.10	28.00
5	Kinnaur		36.78	28.21	40.95
6	Kullu		37.10	34.12	44.61
7	Lahaul & Spiti		31.18	30.79	34.61
8	Mandi		29.10	28.15	37.28
9	Shimla		32.32	27.35	34.23
10	Sirmaur		30.25	30.18	36.50
11	Solan		23.43	19.94	29.95
12	Una		15.74	16.85	28.22
Himachal Pradesh		**Total**	**24.33**	**22.90**	**33.71**
		Male	**31.38**	**28.44**	**28.82**
		Female	**17.08**	**17.21**	**38.77**

Source: Computed from the data taken from Statistical Outline of Himachal Pradesh, Department of Economics and Statistics (various issues), Shimla-9, Government of Himachal Pradesh.

However, Shimla, Sirmaur, Solan and Una experienced increase in per cent share of workers engaged in agriculture out of the overall population (AWPR), respectively, from

32.32 per cent to 34.23 per cent, 30.25 per cent to 36.50 per cent, 23.43 per cent to 29.95 per cent and 15.74 per cent to 28.22 per cent overtime between 1981 and 2001 whereas except Una it came down during 1991. Broadly speaking, agricultural work participation rate was the highest in Kullu during 1981 (37.10%), 1991 (34.12%) and 2001 (44.61%) while the lowest agricultural work participation rate was recorded in Una (15.74%) during 1981, but it was observed in Kangra during 1991 (16.10%) and 2001 (28.00%). Nevertheless, the highest rate of increase in agricultural work participation rate was registered in Hamirpur (17.99 per cent points) whereas the lowest was recorded in Shimla (1.91 per cent points) between 1981 and 2001.

4.7. Contribution of Agriculture to the State Economy

As agriculture grows, it makes, *inter alia,* a product contribution because any increase in the net output of agriculture represents a rise in total product of the country, since the latter is the sum of the increases in the net products of several sectors (Kuznets 1965). Agriculture has been the main contributor to gross domestic product (GDP) in developing countries, especially in the early stages of economic growth. Thus, it provides basis for industrial development. Overtime as industries and services sectors grow, the share of agriculture in gross domestic product tends to decline. However, gross domestic product has been the single most important indicator of economic development of any region or country, Himachal Pradesh being no exception. The primary, secondary and tertiary sectors of the state have grown at an annual rate of 1.56 per cent, 6.11 per cent and 6.17 per cent during 1970-71 to 2000-01, respectively. The growth of the state's economy has mostly depended on the performance of the agricultural sector. That is to say, its economic growth was the highest (6.4%) between 1985-86 and 1990-91. This corresponded to the time when the growth of agriculture sector was also the highest (4.72%). Similarly, the annual growth rate of the economy was the lowest between 1975-76 and 1980-81. This was the period when agriculture sector experienced a negative growth rate (0.34%), (HPDR 2005). Table 4.7.1 portrays contribution of agriculture to gross state domestic product (GSDP) over a period of time from 1980-81 to 2010-11. By simply eyeballing the table it can be realized that the value of total output produced in the state grew up from Rs. 670270 *lakh* to Rs. 3606397 *lakh* between the triennium ending 1982-83 and 2010-11. That is, the gross state domestic product increased by about 5.4 times or Rs. 2936127 *lakh* over the period of study. Likewise, the value of total output created in agriculture increased from Rs. 228619 *lakh* in 1982-83 to Rs. 519643 *lakh* in

2010-11. Thus, gross state domestic product originating from agriculture increased by nearly 2.3 times (more than doubled) or added an amount of Rs. 291024 *lakh* during the last three decades. Although, the value of total output originating from agriculture went up by more than double during the last three decades, its share in gross state domestic product (GSDP) declined continuously from 34.11 per cent to 14.41 per cent between 1982-83 and 2010-11. It could be mainly due to higher rates of growth in industry and services sectors in the state during this period. A graphic presentation of the trends in gross state domestic product and GSDP created in agriculture sector is given in *Appendix 6* while that for the share of agriculture in GSDP is given in *Appendix 7*.

Table 4.7.1 Contribution of Agriculture to Gross State Domestic Product (GSDP) in Himachal Pradesh, 1980-81 to 2010-11. ***(Rs. Lakh at 2004-05 prices)***

Triennium Ending (TE)	Gross State Domestic Product (GSDP)	GSDP Created in Agriculture Sector	Share of Agriculture Sector in GSDP (%)
1982-83	670270	228619	34.11
1990-91	996297	303726	30.49
2000-01	1762896	334690	18.99
2010-11	3606397	519643	14.41

Source: Computed from the data taken from Central Statistics Office, National Accounts, Ministry of Statistics and Programme Implementation, Government of India.

Table 4.7.2 portrays the compound annual growth rates of gross state domestic product, gross state domestic product originating in agriculture and the share of agriculture in gross state domestic product during 1980-81 to 2010-11. This overall period was further broken into two sub-periods i.e. first period from 1980-81 to 1994-95 and second period from 1995-96 to 2010-11. It is evident from the table that gross state domestic product (GSDP) grew up at the rate of 6.28 per cent per annum (% p.a.) during the last three decades, 1980-81 to 2010-11. Similarly, it increased during the first and second periods of study by registering significant growth rates of 5.16 per cent and 7.23 per cent per annum, respectively. The increase was, however, more in the second period as compared to the first one. Furthermore, analysis of the growth performance of gross state domestic product created in agriculture demonstrated that it went up considerably at the rate of 3.00 per cent per annum over the last three decades, 1980-81 to 2010-11. In the same fashion, a conspicuous increase in gross state domestic product originating in agriculture was observed during the first and second study periods with annual growth rates of 2.59 per cent and 4.35 per cent, in that order. Besides, analysis of the growth path of per cent share

of agriculture in gross state domestic products revealed that it diminished significantly at the rate of 3.09 per cent per annum over the last three decades, 1980-81 to 2010-11. Similarly, over the first and second periods the per cent share of agriculture in gross state domestic product registered considerable decreasing annual growth rates of 2.45 per cent and 2.68 per cent, in that sequence. The better performance of the overall economy in general and agriculture in particular during the second period may be attributed to the pro-active economic reforms and increased emphasis on agricultural development during the past one decade or so in the state.

Table 4.7.2 Compound Annual Growth Rates of Gross State Domestic Product (GSDP), GSDP Originated from Agriculture Sector, and Share of Agriculture Sector in GSDP (at 2004-05 prices), 1980-81 to 2010-11. ***(per cent per annum)***

Periods	Gross State Domestic Product (GSDP)	GSDP Created in Agriculture Sector	Share of Agriculture Sector in GSDP
First Period[47]	5.16** (0.32)	2.59** (0.51)	-2.45** (0.40)
Second Period[48]	7.23** (0.14)	4.35** (0.43)	-2.68** (0.47)
Overall[49]	6.28** (0.12)	3.00** (0.19)	-3.09** (0.16)

Note: (**) denotes significance at 1% probability level.
Figures in brackets denote standard errors of growth rates.
Source: Computed from the data taken from Central Statistics Office, National Accounts, Ministry of Statistics and Programme Implementation, Government of India.

4.8. Agricultural Development

Agricultural development may mean different things to different people but the term is generally used to denote the transformation of agriculture from a traditional sector dominated by the use of conventional farming inputs and traditional agricultural practices, to a modern commercial sector wherein modern inputs and scientific agricultural practices are intensively adopted. In this process some areas move ahead of others due to a number of factors. With the background and analysis of spacio-temporal variations in agricultural performance in the earlier sections, an attempt was made in this section to measure

[47] First period covers 1980-81 to 1994-95.
[48] Second period covers 1995-96 to 2010-11.
[49] Overall period covers 1980-81 to 2010-11.

agricultural development across the districts in the state as well as the inter-district disparities in agricultural development.

4.8.1. Levels of Agricultural Development across Districts

Determining the levels of regional development has been a common practice. International and national organizations are often interested in classifying the countries or regions in terms of their development performance in various fields and economic sectors. Such an exercise is useful in the sense that it provides the countries and regions with important policy implications. Hence, in the present study an attempt was made to determine the levels of agricultural development of the districts at two points of time, viz., 1991-92 and 2004-05 using fifteen standard agricultural development indicators (*see Table 3.1*). Table 4.8.1 and Table 4.8.2 depict agricultural development across districts based on three methods, namely, ranking method, indexing method and agricultural development index (ADI) method during 1991-92 and 2004-05, respectively. By looking at the tables it becomes evident that the districts have got somewhat similar or closer positions at least in any of the two methods in 1991-92 and 2004-05. The tribal district of Lahaul & Spiti secured the first position in terms agricultural development among the twelve districts, in all the three methods during 1991-92 and it kept its place intact in 2004-05. For better understanding and comparison, a summary of the levels of agricultural development during 1991-92 and 2004-05 is presented in table 4.8.3 wherein the districts are classified into two broad categories of more developed and less developed depending upon the median value of the aggregate score. If the aggregate score of a particular district was above or equal to the median of the aggregate score of all the districts then that district was classified as more developed and the one securing below the median was categorized as agriculturally less developed district. A pictorial presentation of the districts in terms of their agricultural development is also depicted on the maps (*see Figure 4.8.1 to 4.8.6*). It can be seen from the Table 4.8.3 that according to the ranking method in 1991-92, Lahaul & Spiti, Kinnaur, Sirmaur, Solan, Kangra, Bilaspur and Una were classified as agriculturally more developed districts whereas Hamirpur, Mandi, Shimla, Chamba and Kullu were listed as agriculturally less developed ones. This classification remained the same during 2004-05 with a slight change such that Mandi replaced Kinnaur, that is, Kinnaur joined the less developed districts while Mandi entered into the category of more developed districts. Moreover, indexing method presented a somewhat similar classification of the districts in terms of agricultural performance in 1991-92 wherein Lahaul & Spiti, Kinnaur, Solan,

Shimla, Sirmaur and Kangra were classified as more developed while Mandi, Hamirpur, Chamba, Bilaspur, Kullu and Una were regarded as less developed districts. Anyhow, these districts maintained their respective positions in 2004-05 with a minor change wherein Mandi and Sirmaur swapped places. Nevertheless, the agricultural development index method provided a somewhat closer classification of the districts' levels of agricultural development as that of ranking and indexing methods. On the basis of this method, in 1991-92 Lahaul & Spiti, Sirmaur, Kangra, Solan, Hamirpur and Mandi were put in the category of more developed districts but Bilaspur, Una, Shimla, Kinnaur, Chamba and Kullu were found to be agriculturally less developed districts. However, this classification remained nearly the same during 2004-05 with Una replacing Hamirpur from the category of more developed districts to that of less developed districts. Thus, it becomes evident that according to all the three methods of determining the levels of agricultural development used in the present study, agriculturally more developed and less developed districts in 1991-92 almost remained as more developed and less developed during 2004-05 with very small changes such that Mandi replaced Kinnaur in the ranking method, Sirmaur exchanged position with Mandi in the indexing method and Una substituted Hamirpur in case of agricultural development index method. But the rank positions of the district did change for most of the districts between 1991-92 and 2004-05.

In conclusion, Lahaul & Spiti, Solan, Sirmaur and Kangra were categorized as agriculturally more developed districts by all the three methods during 1991-92 while Kinnaur was considered as more developed by the methods of ranking and indexing alone. However, only Chamba and Kullu were classified as being agriculturally less developed districts by all the three methods in 1991-92 whereas Mandi and Hamirpur were treated as less developed merely by the methods of ranking and indexing but Shimla was listed as less developed by the method of ranking and agricultural development index method. Furthermore, during 2004-05 based on all the three methods Lahaul & Spiti, Kangra, Mandi and Solan were classified as agriculturally more developed districts but the two districts of Sirmaur and Una were listed as being more developed by the method of ranking and agricultural development index method alone. Nevertheless, according to all the three methods in 2004-05, Chamba, Hamirpur and Kullu were classified as being agriculturally less developed but Kinnaur and Shimla were put in this category only by the methods of ranking and agricultural development index.

Table 4.8.1 Agricultural Development across Districts in Himachal Pradesh, 1991-92.

Districts	Methods					
	Ranking		Indexing		ADI	
	Rank Score	Rank	Index Score	Rank	ADI Score	Rank
Bilaspur	97	6	947	10	0.446	7
Chamba	83	11	980	9	0.348	11
Hamirpur	96	8	986	8	0.458	5
Kangra	101	5	1058	6	0.477	3
Kinnaur	105	2	1278	2	0.413	10
Kullu	70	12	822	11	0.306	12
Lahaul & Spiti	128	1	2196	1	0.658	1
Mandi	94	9	1057	7	0.452	6
Shimla	91	10	1115	4	0.426	9
Sirmaur	104	3	1104	5	0.480	2
Solan	104	3	1130	3	0.465	4
Una	97	6	527	12	0.434	8

Note: ADI stands for Agricultural Development Index.

Table 4.8.2 Agricultural Development across Districts in Himachal Pradesh, 2004-05.

Districts	Methods					
	Ranking		Indexing		ADI	
	Rank Score	Rank	Index Score	Rank	ADI Score	Rank
Bilaspur	95	6	864	11	0.483	7
Chamba	80	11	908	9	0.376	12
Hamirpur	90	9	748	12	0.459	8
Kangra	108	3	1196	3	0.545	2
Kinnaur	92	8	1284	2	0.414	10
Kullu	78	12	879	10	0.377	11
Lahaul & Spiti	128	1	2122	1	0.645	1
Mandi	103	4	1117	4	0.517	4
Shimla	84	10	1073	6	0.456	9
Sirmaur	95	6	990	7	0.485	6
Solan	103	4	1082	5	0.497	5
Una	111	2	937	8	0.544	3

Note: ADI stands for Agricultural Development Index.

Table 4.8.3 Summary of the Levels of Agricultural Development across Districts in Himachal Pradesh, 1991-92 and 2004-05.

Levels of Agricultural Development	Methods					
	Ranking		Indexing		ADI	
	1991-92	2004-05	1991-92	2004-05	1991-92	2004-05
More Developed	Lahaul & Spiti	Lahaul & Spiti	Lahaul & Spiti	Lahaul & Spiti	Lahaul & Spiti	Lahaul & Spiti
	Kinnaur	Una	Kinnaur	Kinnaur	Sirmaur	Kangra
	Sirmaur	Kangra	Solan	Kangra	Kangra	Una
	Solan	Solan	Shimla	Mandi	Solan	Mandi
	Kangra	Mandi	Sirmaur	Solan	Hamirpur	Solan
	Bilaspur	Bilaspur	Kangra	Shimla	Mandi	Sirmaur
	Una	Sirmaur				
Less Developed	Hamirpur	Kinnaur	Mandi	Sirmaur	Bilaspur	Bilaspur
	Mandi	Hamirpur	Hamirpur	Una	Una	Hamirpur
	Shimla	Shimla	Chamba	Chamba	Shimla	Shimla
	Chamba	Chamba	Bilaspur	Kullu	Kinnaur	Kinnaur
	Kullu	Kullu	Kullu	Bilaspur	Chamba	Kullu
			Una	Hamirpur	Kullu	Chamba

Note: ADI stands for Agricultural Development Index.

Fig. 4.8.1

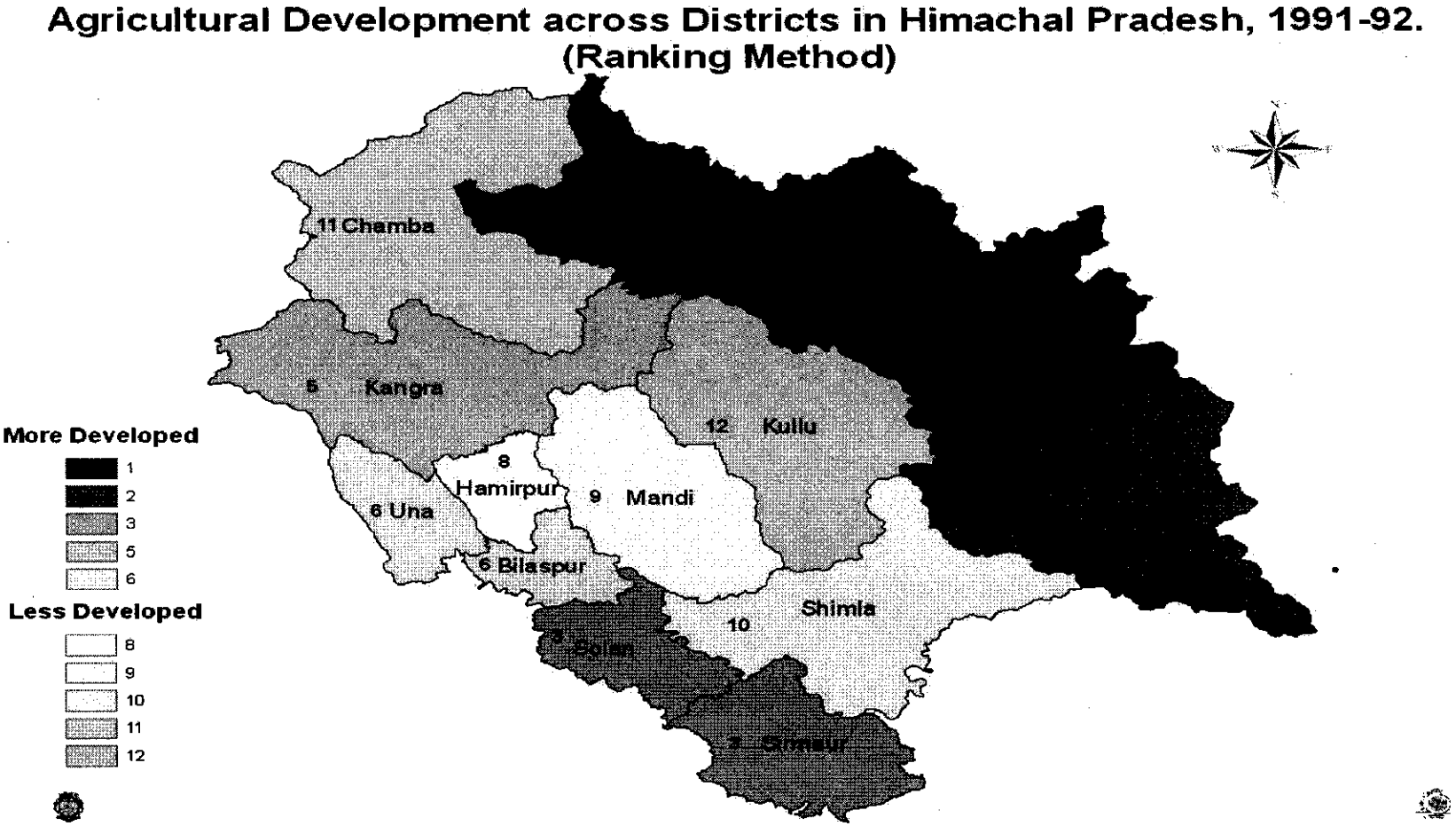

Agricultural Development across Districts in Himachal Pradesh, 1991-92.
(Ranking Method)
11 Chamba
5 Kangra
12 Kullu
8 Hamirpur
9 Mandi
6 Una
6 Bilaspur
10 Shimla
3 Sirmaur
More Developed
1
2
3
5
6
Less Developed
8
9
10
11
12
Centre for Geo-Informatics, CSK Himachal Pradesh Agricultural University, Palampur

Fig. 4.8.2

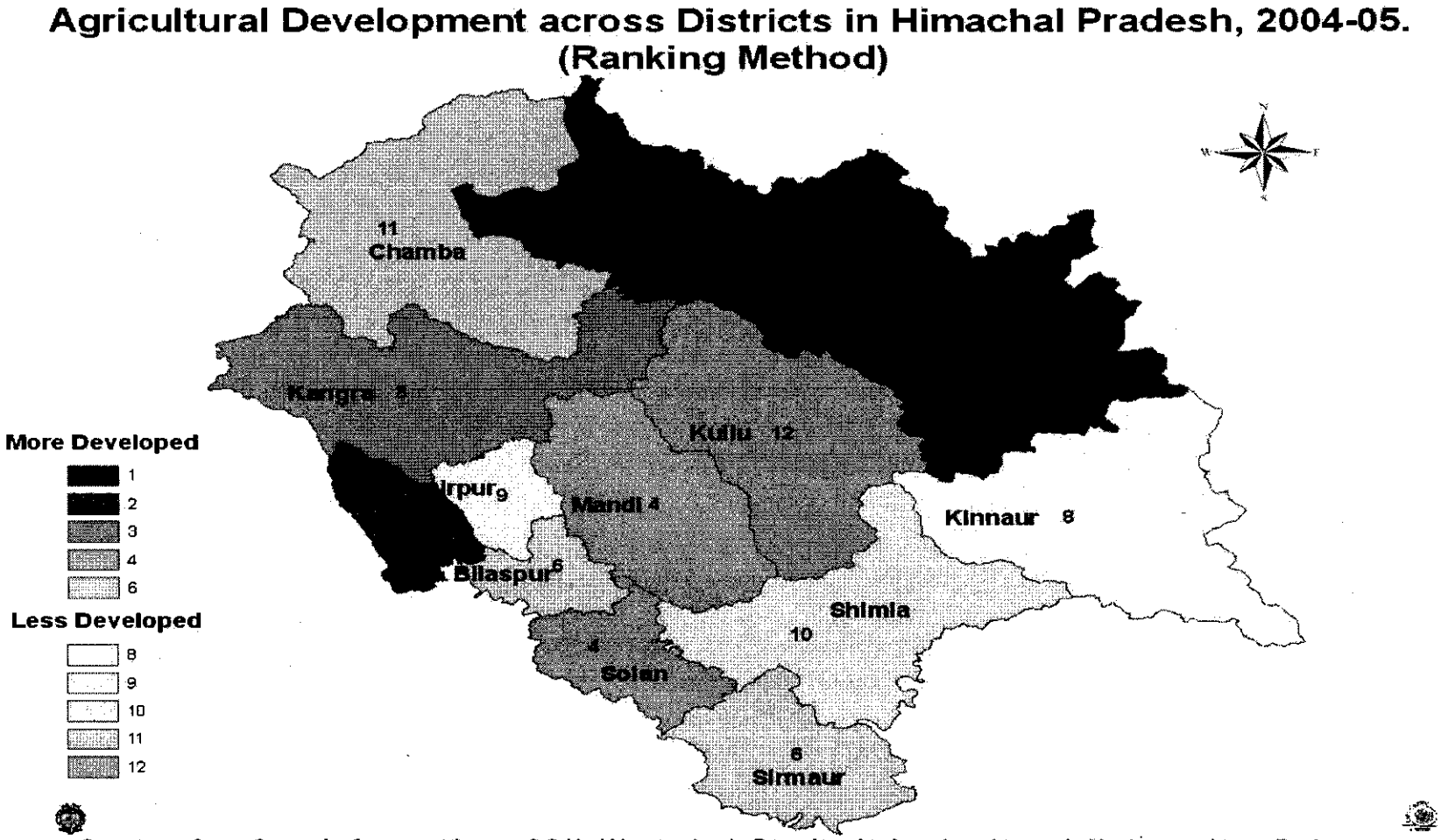

Agricultural Development across Districts in Himachal Pradesh, 2004-05.
(Ranking Method)
More Developed
1
2
3
4
6
Less Developed
8
9
10
11
12
11
Chamba
Kangra 3
Kullu 12
Irpur 9
Mandi 4
Bilaspur 5
Kinnaur 8
Shimla
10
Solan
6
Sirmaur
Centre for Geo-Informatics, CSK Himachal Pradesh Agricultural University, Palampur

Fig. 4.8.3

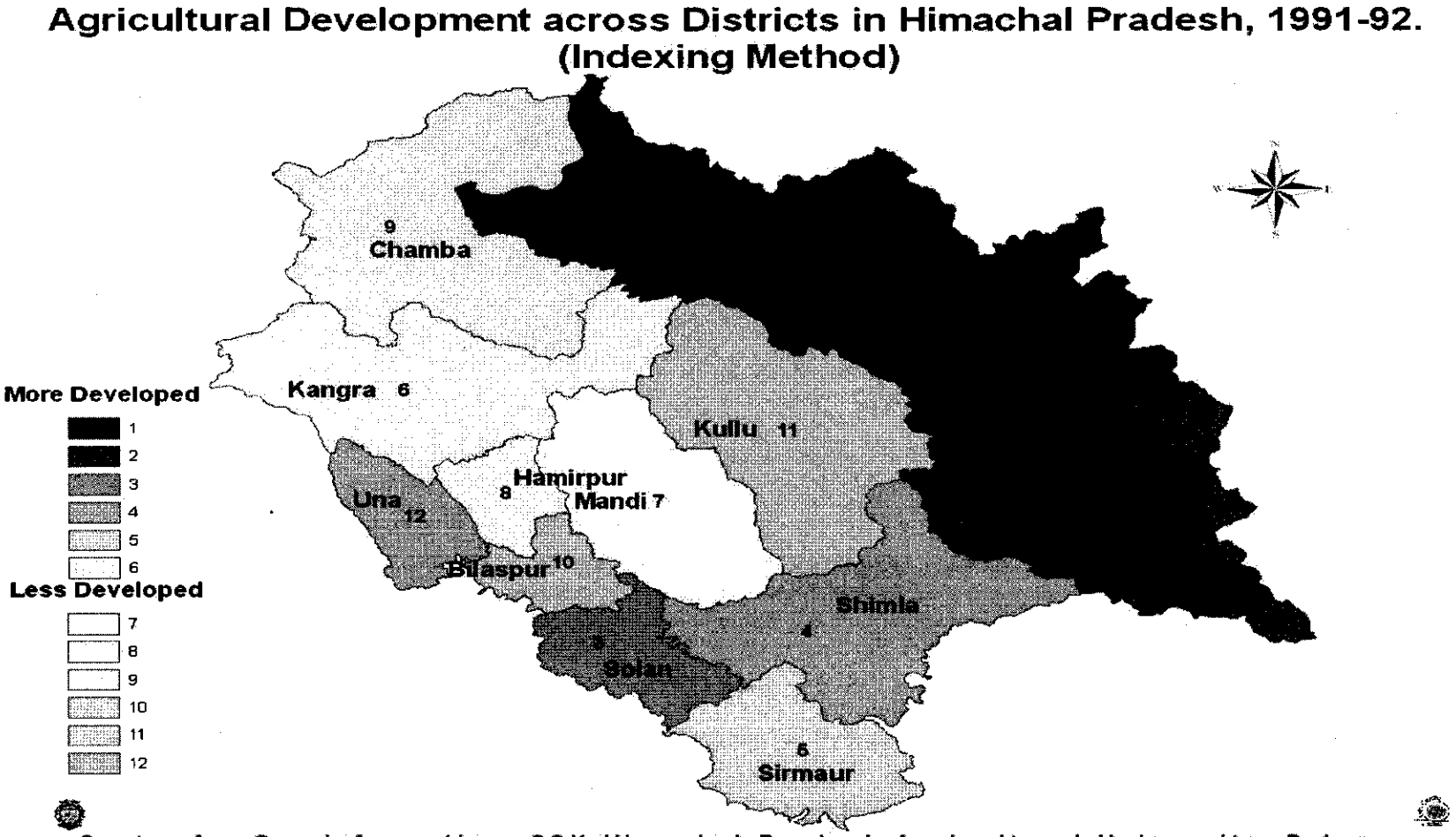

Agricultural Development across Districts in Himachal Pradesh, 1991-92.
(Indexing Method)
More Developed
1
2
3
4
5
6
Less Developed
7
8
9
10
11
12
9
Chamba
Kangra 6
Kullu 11
Hamirpur
8
Mandi 7
Una
12
Bilaspur 10
Shimla
4
Solan
3
5
Sirmaur
Centre for Geo-Informatics, CSK Himachal Pradesh Agricultural University, Palampur

Fig. 4.8.4

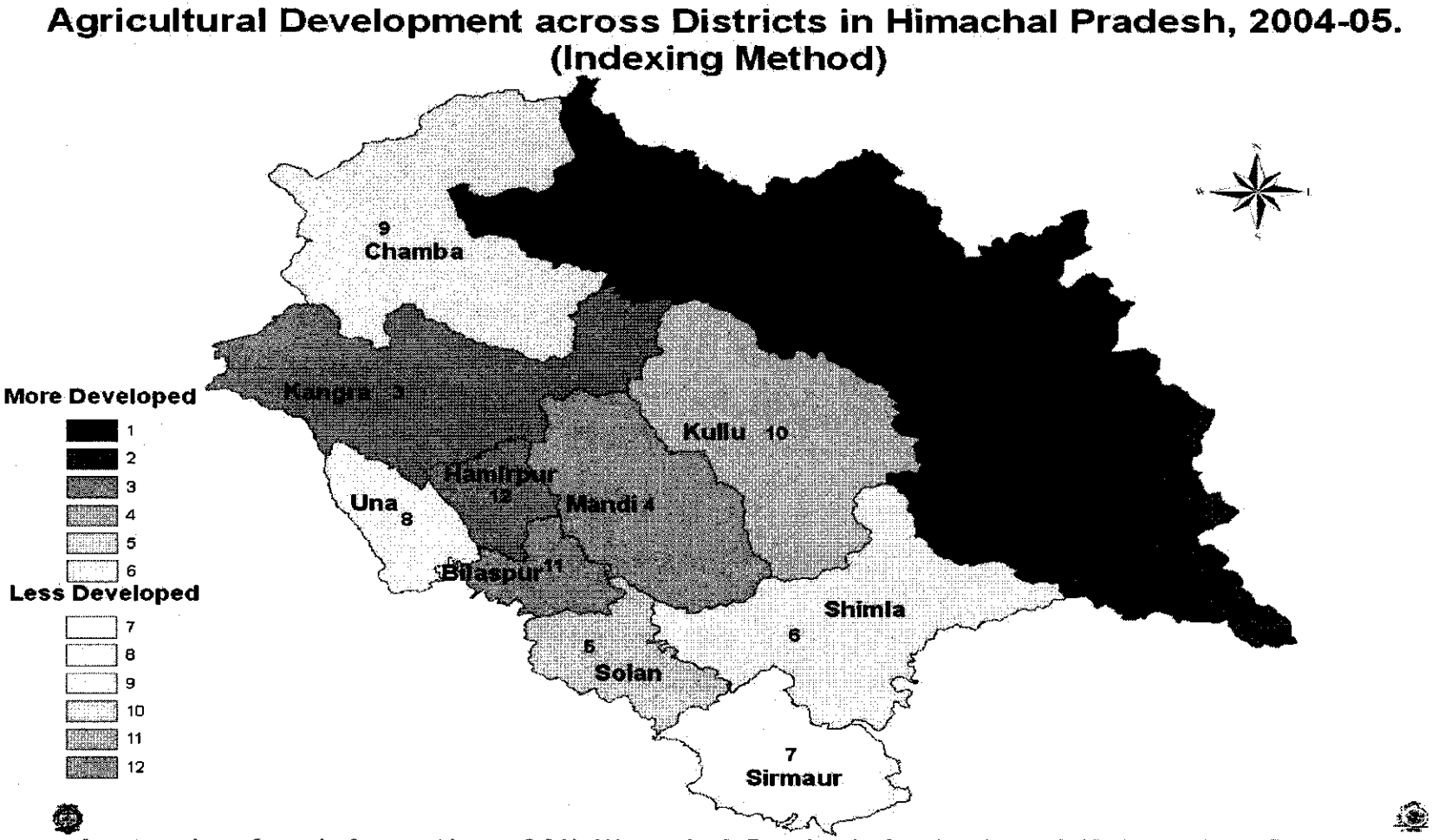

Agricultural Development across Districts in Himachal Pradesh, 2004-05.
(Indexing Method)
More Developed
1
2
3
4
5
6
Less Developed
7
8
9
10
11
12
9
Chamba
Kangra 3
Hamirpur
12
Una
8
Bilaspur 11
Mandi 4
Kullu 10
Shimla
6
5
Solan
7
Sirmaur
Centre for Geo-Informatics, CSK Himachal Pradesh Agricultural University, Palampur

Fig. 4.8.5

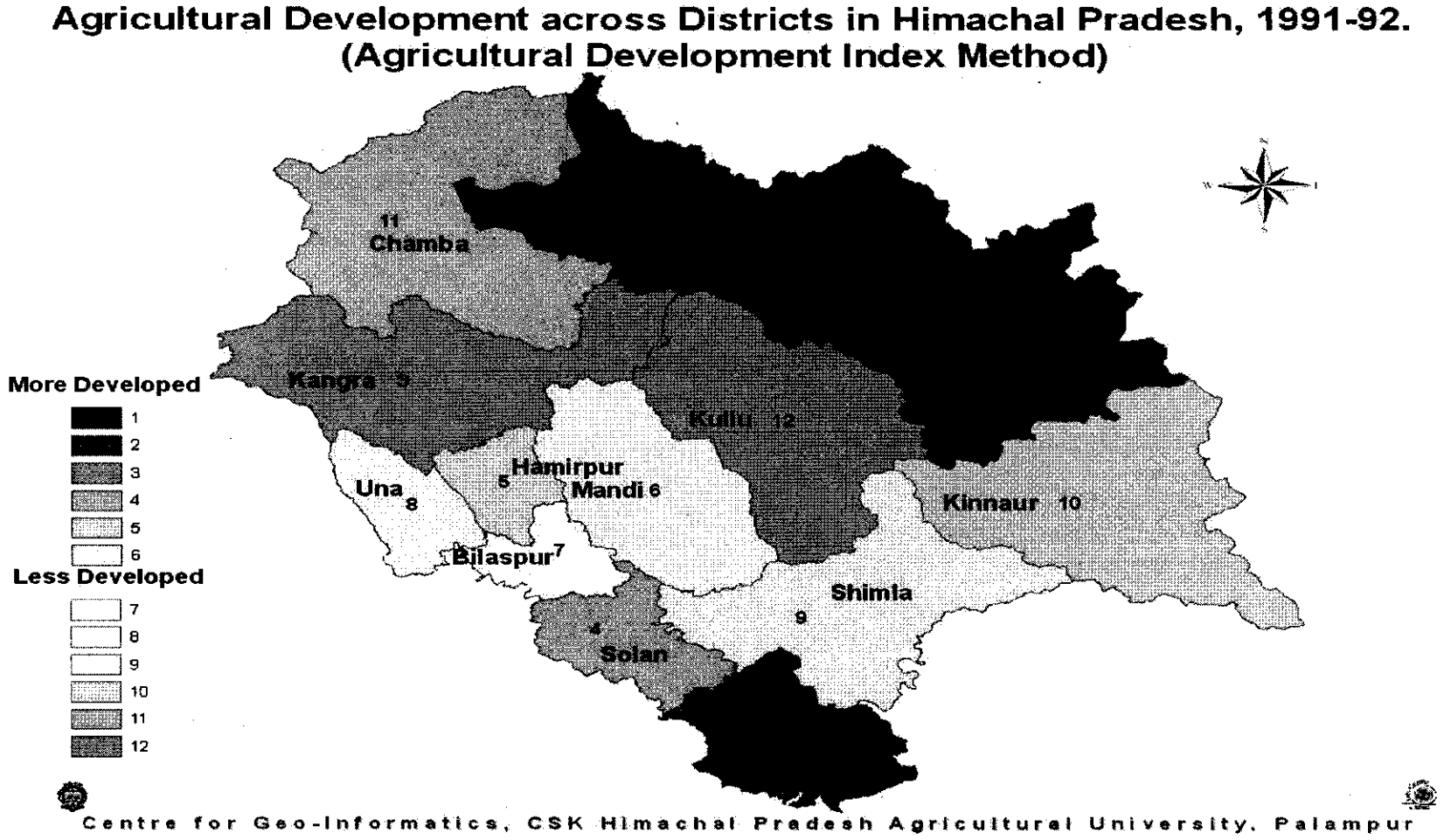
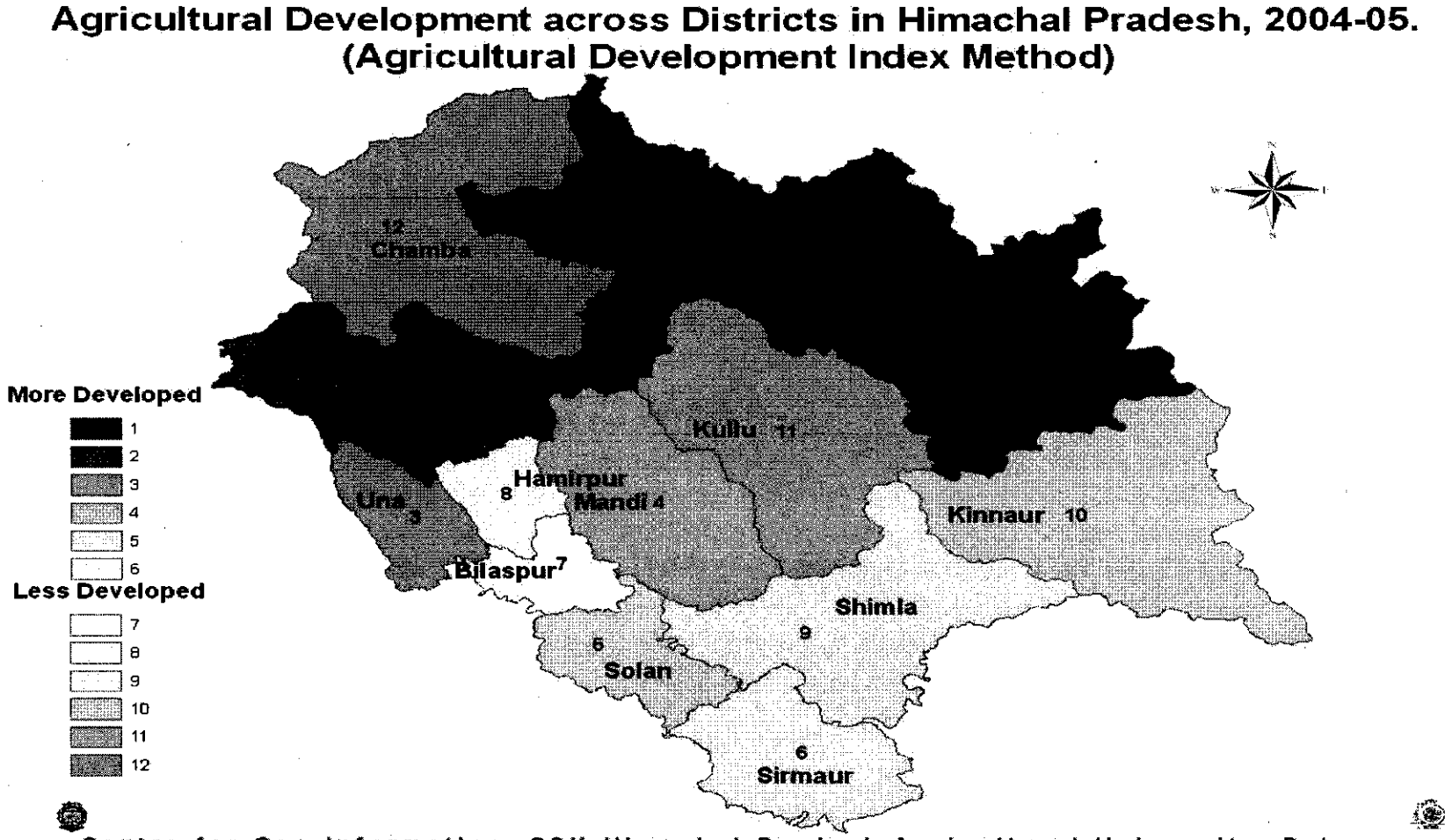

Agricultural Development across Districts in Himachal Pradesh, 1991-92.
(Agricultural Development Index Method)
More Developed
1
2
3
4
5
6
Less Developed
7
8
9
10
11
12
11
Chamba
Kangra 3
Kullu 12
Hamirpur
5
Mandi 6
Una
8
Bilaspur 7
Kinnaur 10
Shimla
9
4
Solan
Centre for Geo-Informatics, CSK Himachal Pradesh Agricultural University, Palampur

Fig. 4.8.6


Agricultural Development across Districts in Himachal Pradesh, 2004-05.
(Agricultural Development Index Method)
More Developed
1
2
3
4
5
6
Less Developed
7
8
9
10
11
12
12
Chamba
Kullu 11
Hamirpur
8
Mandi 4
Una 3
Kinnaur 10
Bilaspur 7
Shimla
9
6
Solan
6
Sirmaur
Centre for Geo-Informatics, CSK Himachal Pradesh Agricultural University, Palampur

4.8.2. Inter-District Disparities in Agricultural Development

Inequalities in the process of economic development have been a matter of debate among academics, researchers, planners and policy makers, since long times. Agricultural development could not be an exception rather it is dominated by vast inter-regional as well as intra-regional disparities. Agro-climatic conditions, resource endowments, topography, institutional and socio-economic factors are said to be responsible for these discrepancies. However, the climatic condition and topography of hilly regions such as Himachal Pradesh are quite variable that affect agriculture in these areas in different ways. Hence, an analysis of these variations in agricultural development among the districts was carried out in the present study. For this coefficient of variation was calculated for the fifteen indicators used in determining the levels of districts' agricultural development. Table 4.8.4 portrays the disparities in agricultural development among the districts in Himachal Pradesh during 1991-92 to 2004-05. It can be easily seen from the table that the disparities widened at varying rates between the districts with regards to eight indicators of agricultural development, viz., cropping intensity, average size of holding, foodgrains productivity, agricultural diversification index, number of commercial banks per 1000 cultivators, number of agricultural credit cooperatives per 1000 cultivators, area under high yielding varieties of major crops and magnitude of culturable waste land, during 1991-92 to 2004-05. But these discrepancies contracted between the districts at various degrees for the rest seven indicators of agricultural development, namely, fertilizer consumption, irrigation intensity, area under non-foodgrains, workers engaged in agriculture, irrigation extent (net irrigated area as percentage of net sown area), net sown area per cultivator and magnitude of other fallow land, during the study period. In other words, the districts were diverging in relation to eight indicators of agricultural development while they were on the converging mode with regard to the remaining seven indicators of agricultural development used in the present study. A graphic presentation of these disparities is given in *Appendix 4*. Nevertheless, among the indicators of agricultural development witnessed convergence between the districts, magnitude of other fallow land, fertilizer consumption and net sown area per cultivator depicted considerable decline in inequalities by 95.68 per cent points, 13.78 per cent points and 11.50 per cent points, respectively. The convergence in fertilizer consumption might be attributed to the increase in its consumption which grew up in most of the districts, that in case of net sown area per cultivator could be due to the decline in average size of holdings in most of the districts while the decrease in disparities with

respect to other fallows may be due to increase in its magnitude in most of the districts, during the study period. Contrarily, the disparities among the districts with respect to area under high yielding varieties of major crops, number of agricultural credit cooperatives per 1000 cultivators and magnitude of culturable waste land widened substantially by 35.88 per cent points, 17.35 per cent points and 13.26 per cent points, in that order, during the study period.

Table 4.8.4 Disparities in Agricultural Development among the Districts in Himachal Pradesh, 1991-92 to 2004-05. ***(per cent)***

Sr. No.	Indicators	Coefficient of Variation (C.V.)	
		1991-92	2004-05
1	Fertilizer Consumption	67.48	53.70
2	Irrigation Intensity	23.93	22.72
3	Cropping Intensity	16.89	17.99
4	Area under Non-foodgrains	104.32	101.22
5	Average Size of Holding	34.07	35.57
6	Productivity of Foodgrains	19.56	20.15
7	Agricultural Diversification: Herfindahl Index	24.31	27.89
8	Workers Engaged in Agriculture	16.60	10.76
9	Net Irrigated Area as Percentage of Net Sown Area	107.13	101.69
10	Net Sown Area Per Cultivator	25.78	14.28
11	Number of Commercial Banks per 1000 Cultivators	27.84	30.69
12	Number of Agricultural Credit Cooperatives per 1000 Cultivators	66.20	83.55
13	Area under High Yielding Varieties of Major Crops	11.48	47.36
14	Magnitude of Culturable Waste Land	70.75	84.01
15	Magnitude of Other Fallow Land	193.62	97.94

Chapter 5

Summary And Conclusions

5. SUMMARY AND CONCLUSIONS

An overview of the process of investigation and the results so derived is an important part on any research project. More often than not, readers prefer to go through the summary of research instead of reading the entire text so as to get a quick knowledge of the study. Hence, this chapter is designed to provide a summary of the present study as well as the concluding remarks highlighted in the course of analysis. To ensure systematic presentation of materials, this chapter is organized under the following headings:

5.1. Introduction

5.2. Objectives

5.3. Methodology

5.4. Salient Findings

5.5. Conclusions and Policy Implications

5.1. Introduction

Agriculture sector plays a strategic role in the process of economic development. It can work in concert with other sectors to produce faster growth, reduce poverty and sustain the environment. Agriculture contributes to development in many ways i.e. as an economic activity, as a livelihood and as a provider of environmental services. But, its contribution to development varies across countries depending on how they rely on agriculture as a source of growth and an instrument for poverty reduction. The study of economic history indicates that an agricultural revolution is the basic pre-requisite for economic development. That is to say, the sector has the potential to be the industrial and economic springboard from which a country's development can take off. Although, agriculture is a primary contributor to growth, particularly in the initial stages of development, it neither can function in isolation from the wider economy nor it can drive growth alone. Rather, it requires a supportive and enabling environment as well as structural and institutional changes in rest of the economy.

Himachal Pradesh is one of the dynamic hilly and mountainous states of Indian Union located in Western Himalayas. It has an area of 55,673 sq km and a population of 68.6 *lakh* of which about 90 per cent is living in rural areas and mostly depends on

agriculture as a livelihood. Following several changes and re-organization in its administrative structure, Himachal Pradesh became a full-fledged state of Indian Union in January 1971. It was overwhelmingly rural and agrarian state, major parts of the state were in the immense shortage of infrastructure facilities and agriculture was the least developed. However, growth of the state's economy has mostly depended on its performance of agriculture sector. Its topography, soil, climate, rainfall and temperature provide the state with vast opportunities for agriculture and horticulture sectors. A large number of crops are grown in the state. It is especially well-known for its fruits and vegetables production. The accomplishments in the fruit farming have earned the state an eminent place on the horticultural map of India and the state has come to be known as '*Apple State of India*'. Nevertheless, agriculture in the state suffers from certain limitations. Most of the farming is rainfed and only about one *lakh* hectares of its net sown area receives irrigation. Operational holdings are small and scattered, fruit cultivation is thriving on old plantations whose bearing is low, farm mechanization is insufficient, awareness level of farmers is low and technologies are outdated.

The hill and mountain areas of Himalayan region are ecologically fragile and generally less developed. Majority of hill inhabitants depend upon agriculture for their livelihood and the agricultural development in these regions is restricted by the mountains specificities, viz., inaccessibility, marginality, fragility, niche and human adaptation mechanism created by the unique vertical dimensions that distinguish them from the plains and other ecosystems. Due to low and stagnant productivity, the output produced by the sector is unable to meet the requirements of hill people and there is no surplus for satisfying their other needs. However, among various hill states and regions, Himachal Pradesh is recognized as the most progressive state which has achieved considerable progress in socio-economic development of its people and it is considered as a model for development of Hindukush Himalayan region.

Agricultural development indicators change in its magnitude as a function of time and space. These changes have got more momentum, *inter alia*, in Indian agriculture with the commencement of the Green Revolution, economic reforms of 1991, the signing of agreement of World Trade Organization (WTO) and consequent liberalization of trade that necessitated many structural and institutional changes in the sector. The agricultural development indicators of Himachal Pradesh underwent several changes since then. The process of agricultural diversification, which was hitherto confined to selected pockets and

valleys in the higher and mid-hill areas, has expanded to new areas in the low and mid-hills of the state. Many new developments such as protected cultivation, organic farming, micro irrigation and growing of more lucrative crops have added new dimensions to agriculture in the state. However, agricultural development in the state is uneven rather it is dominated by vast inter-regional as well as intra-regional disparities that often act as restraint to agricultural development in the state. As a result of these disparities, some districts might have progressed more as compared to others. An empirical examination of these developments was deemed necessary because it could provide an exhaustive scrutiny of agricultural development in the state that will help policy makers and planners in decision making and navigating the development process of the state to new horizons. Such an exercise can also help in identifying the constraints to agricultural development in these areas and in revealing the success stories. This can contribute in designing appropriate strategies for the balanced agricultural development in the state. With this background in mind, the present study was designed to achieve the following twin objectives.

5.2. Objectives

i. To study the spacio-temporal changes in agriculture and its contribution to the state economy, and
ii. To measure the level of agricultural development across different districts, identify major constraints and suggest appropriate development strategies.

5.3. Methodology

The present study was geographically confined to the state of Himachal Pradesh encompassing its twelve districts as the ultimate units of analysis. It was primarily based on the time-series secondary data, covered the recent two to four decades or so, which were collected at the district as well as state level for a number of agricultural development indicators, namely, *land use, production of major crops and crop groups, area under major crops and crop groups, net and gross irrigated area, fertilizer consumption, area under high yielding varieties, land holdings, agricultural implements, gross state domestic product (GSDP), employment, etc.,* from various published documents such as *Statistical Outline of Himachal Pradesh,* a publication of the *Directorate of Economics and Statistics, Annual Season and Crop Report published by Directorate of Land Records, Fertilizer Statistics brought out by The Fertilizer Association of India, New Delhi, Primary Census Abstracts, Census of India, Central Statistics Organization (CSO), New Delhi, and website*

of the Ministry of Statistics and Programme Implementation, Government of India. To achieve the designated objectives of the study a number of relevant statistical and econometric techniques such as *the method of moving averages, compound annual growth rates, Herfindahl Index (HI), splicing, ranking method, indexing method, agricultural development index (ADI) method, cropping intensity index, irrigation intensity index, coefficient of variation (CV), etc.* were used in the analysis of various indicators considered in the present study.

5.4. Salient Findings

The major findings identified in the course of investigation are summarized under their respective sections as follow:

5.4.1. Land Use Pattern

It was found that reporting area in the state increased in absolute terms by 1559.53 thousand hectares during the past four decades or so. As far as reporting area at the district level was concerned, it increased substantially in the tribal districts of Lahaul & Spiti (842.3 thousand hectares) and Kinnaur (598.5 thousand hectares) between the triennium ending 1974-75 and 2007-08. Moreover, growth analysis of reporting area at the state level revealed that it registered a growth rate of 1.54 per cent per annum (% p.a.) for the overall period[50], but the rate of increase was higher in the second period[51] (2.21% p.a.) than in the first period[52] (0.93% p.a.). This implied that reporting area in the state grew up at a higher rate during 1990s and onwards. Growth assessment of reporting area at the district level also depicted that the tribal districts of Kinnaur and Lahaul & Spiti registered the highest growth rates of 12.28 per cent and 9.30 per cent per annum, respectively, during the overall period. While Kinnaur witnessed the highest rate of increase (20.44% p.a.) in reporting area during the first period, it was the highest in Lahaul & Spiti in the second period (11.31% p.a.).

Whilst net sown area as percentage of reporting area declined by almost 7 per cent points in the state during the study period; it increased in absolute terms by about 30 thousand hectares between the triennium ending 1974-75 and 1990-91. However, there was a massive decline of about 53 thousand hectares from 1990s onwards. Similarly net

[50] From 1972-73 to 2007-08.
[51] From 1990-91 to 2007-08.
[52] From 1972-73 to 1989-90.

sown area decreased in absolute terms in most of the districts (eight) but the decline was substantial in Kinnaur (8.78 thousand hectares), Solan (5.13 thousand hectares) and Una (4.74 thousand hectares) whereas the highest increase was observed in Kullu (12 thousand hectares) during the study period. Growth analysis of net sown area at the state level showed that it decreased with an annual growth rate of 0.14 per cent during the overall period of study. Whilst net sown area increased (0.37% p.a.) in the first period, it declined (0.55% p.a.) during the second period. This means that net sown area actually declined after 1990s in the state. In case of districts, net sown area went down significantly in half of the districts (six) with the highest decline witnessed in Kinnaur (0.95 % p.a.) during the overall period. While net sown area depicted increasing growth rates in most of the districts during the first period, it displayed declining ones for majority of them in the second period which confirmed the declining trend of net sown area from 1990s onwards.

Per cent share of land put to non-agricultural uses increased in the state by almost 4 per cent points whereas it grew up in absolute terms by about 270 thousand hectares between the triennium ending 1974-75 and 2007-08. Most of the increase came from the cultivable land only. The tribal districts of Lahaul & Spiti and Kinnaur witnessed the highest rate of increase in area put to non-agricultural uses by nearly 13.49 per cent points and 9.65 per cent points, respectively, during the same period. Growth analysis demonstrated that land put under non-agricultural uses increased with a growth rate of 2.54 per cent per annum during the overall period, but the rate of increase was the highest (6.51% p.a.) from 1990s onwards whereas no significant change was observed during the first period in the state. Similarly, area put to non-agricultural uses increased in majority of the districts during the overall period with the annual growth rates varying from 0.52 per cent in Sirmaur to 19.14 per cent in Kinnaur. While Kinnaur registered the highest growth rate of 11.20 per cent per annum in the first period, Lahaul & Spiti witnessed the highest rate of increase (35.08% p.a.) during the second period.

5.4.2. Land Holding

As regards the land holdings, it was observed that the number of farmers grew up continuously in the state and majority of the districts whereas the area available for cultivation depicted an increase up to 1995-96 but it declined slightly in 2005-06. As a result, the size of holdings continued to decline which made them uneconomic and unprofitable for farming. Nevertheless, Sirmaur, Solan, Lahaul & Spiti and Kinnaur were

the districts that registered the largest size of holdings, respectively, whereas Kullu recorded the smallest holding size during 1970-71 to 2005-06. In addition, marginal and small farmers together constituted nearly 87 per cent of total farmers but they owned only about 52 per cent of the total area under plough. Contrarily, medium and semi-medium farmers accounted for around 12 per cent of total farmers in the state but owned about 42 per cent of cultivable land. Although, large farmers constituted only 0.38 per cent of total farmers but they owned 6.20 per cent of agricultural land. Hence, it became evident that wide range of inequalities and disparities existed in the arena of land distribution in the state which is indeed a threat to the growth and viability of marginal and small farmers at least in the medium to long run.

5.4.3. Cropping Pattern

i. Trends in Cropping Pattern

Cropping pattern in the state was observed to be shifting in favour of horticultural crops (apple, other fruits, and other vegetables) and major cereals (maize and wheat) during the study period. Similarly, farmers extracted their land resources from producing rice, 'other cereals' including barley and pulses in most of the districts and allocated it towards producing the major cereals (maize and wheat), horticultural crops (apple, fruits other than apple, and vegetables other than potato), and in some small degrees to oilseeds, potato and fodder crops. Hence, cropping pattern changed in favour of high value cash crops and crops which are essential for food security and feeding animals.

ii. Trends in Production, Area and Yield

It was observed that during all the three points of time considered i.e. 1974-75, 1989-90 and 2004-05, the highest level of production and acreage of rice, wheat, total cereals, foodgrains and oilseeds were witnessed in Kangra. Similarly, Shimla experienced that in case of other cereals and potato. However, the production and area of wheat, total cereals and foodgrains were the lowest in Lahaul & Spiti while that of rice were the lowest in Kinnaur. As far as the magnitude of yield of major crops and crop groups is concerned, the highest levels of yield for majority of the crops and crop groups was witnessed in Lahaul & Spit and Kullu; Lahaul & Spiti, Kinnaur, Chamba and Kullu; and Una, Kinnaur and Lahaul & Spiti during the triennium endings 1974-75, 1989-90 and 2004-05, in that order. Contrarily, the lowest level of yield for most of the crops and crop groups was

observed in Kinnaur and Solan; Solan, Kinnaur and Bilaspur; and Kangra and Kullu during the same points of time, respectively.

iii. Compound Annual Growth Rates of Production of Major Crops

Analysis of growth rates of the production for major crops and crop groups during 1972-73 to 2004-05 (overall period) at the state level revealed that potato production increased with a very high growth rate of 4.27 per cent per annum (% p.a.) whereas that of 'other cereals' and pulses declined significantly with annual growth rates of 4.65 per cent and 3.53 per cent, respectively. But, foodgrains production grew at a lower rate of 1.26 per cent per annum. As far as the growth assessment of production at the district level is concerned, a significant increase in rice production was observed after 1988-89 with Una recording the highest rate of increase (6.55% p.a.). However, it went down in Kullu (2.31% p.a.) and Shimla (3.60% p.a.). Maize and wheat production witnessed upwards growth rates in majority of the districts with the highest rate of increase observed in Lahaul & Spiti (8.39% p.a.) and Una (3.45% p.a.), respectively, during the overall period. However, the production of wheat declined considerably in Lahaul & Spiti (5.83% p.a.), Kinnaur (3.67% p.a.) and Shimla (2.17% p.a.) over the same period. The barely production increased significantly in Bilaspur (4.86% p.a.) and Kinnaur (2.44% p.a.) alone whereas the rate of decline was very high in Lahaul & Spiti (20.44% p.a.) and Bilaspur (7.50% p.a.) during the first and second period, respectively.

While Hamirpur witnessed the highest rate of decline in 'other cereals' production with the growth rates of 32.85 per cent and 13.12 per cent per annum during the first[53] and overall period, respectively, it declined at a very high pace in Kullu (8.22% p.a.) over the second period[54]. Total cereals production grew up in most of the districts at varying rates with the highest growth rate observed in Una (2.64% p.a.) during 1972-73 to 2004-05. But it declined considerably in Lahaul & Spiti (4.10% p.a.), Kinnaur (1.56% p.a.) and Shimla (1.45% p.a.) over the same period. Kinnaur was the only district where pulses production increased significantly in the first, second and overall periods at the rate of 13.11 per cent, 13.91 per cent and 11.96 per cent per annum, respectively. However, it went down in majority of the districts with the highest decline observed in Hamirpur (12.31% p.a.) during the overall period. Besides, potato production grew up in all the districts, though not

[53] From 1972-73 to 1987-88.
[54] From 1988-89 to 2004-05.

significant for few of them, registering annual growth rates ranging from 3.75 per cent in Lahaul & Spiti to 12.45 per cent in Chamba over the same period. The increase in oilseeds production was observed to be the highest in Shimla (8.77% p.a.) while it declined considerably in Solan (3.30% p.a.) during the overall period.

iv. Compound Annual Growth Rates of Area under Major Crops

Analysis of growth rates of area under major corps and crop groups at the state level revealed that the area under rice, 'other cereals', pulses, foodgrains and oilseeds came down considerably whereas that of maize, wheat, apple, other fruits, other vegetables and fodder crops grew up significantly during 1972-73 to 2004-05 (overall period). While the acreage under pulses and 'other cereals' experienced substantial decline of 3.66 per cent and 2.85 per cent per annum (% p.a.), respectively, other vegetables, other fruits and apple witnessed pronounced increase in area with growth rates of 6.31 per cent, 5.54 per cent and 4.54 per cent per annum, in that order, during the same period. As regards the districts, area under rice underwent a decline in most of the districts, though not significant for some of them, during the overall period with the highest rate of decrease observed in Bilaspur (3.12% p.a.). However, it increased substantially in Una (3.97% p.a.) and Kinnaur (3.16% p.a.) during 1988-89 to 2004-05. Area put under maize and wheat increased in most of the districts with the highest growth rates observed in Lahaul & Spiti (3.27% p.a.) and Kullu (1.18% p.a.) during 1972-73 to 2004-05. The decline in wheat acreage was substantial in Kinnaur (5.36% p.a.), Lahaul & Spiti (4.72% p.a.) and Shimla (2.27% p.a.) during the same period.

Acreage of 'other cereals' came down in most of the districts during all the three periods. While Hamirpur witnessed the highest rate of decline during first[55] (22.98% p.a.) and overall period (6.31% p.a.), it declined substantially in Una (27.87% p.a.) during the second period[56]. Similarly, area allotted to pulses decreased in majority of the districts over all the three periods. The rate of decline was observed to be the highest in Hamirpur during the second (16.24% p.a.) and overall period (13.17% p.a.) whereas it decreased considerably in Una during the first period (12.34% p.a.). However, Kinnaur was the only districts where acreage under pulses increased significantly during first (5.55% p.a.), second (1.85% p.a.) and overall period (5.25% p.a.).

[55] From 1972-73 to 1987-88.
[56] From 1988-89 to 2004-05.

Area allotted to apple and other fruits witnessed an increasing trend in majority of the districts during 1972-73 to 2004-05. The rate of increase in area under apple was observed to be the highest in Chamba (13.56% p.a.) whereas that of other fruits was the highest in Shimla (19.14% p.a.) during the same period. Besides, the increase in area under potato was observed to be the highest in Una (7.08% p.a.) whereas it declined substantially in Kinnaur (2.84% p.a.) during the overall period. While Shimla witnessed a continuous decrease in potato acreage, it grew up ceaselessly in Sirmaur and Una over all the three periods. Area under vegetables other than potato (other vegetables) increased in majority of the districts during all the three periods. Whilst acreage of other vegetables increased with the highest growth rate in Mandi (15.82% p.a.) during the first period, it grew up conspicuously in Kinnaur during the second (14.28% p.a.) and overall period (12.19% p.a.). However, the increase in oilseeds acreage was observed to be the highest in Shimla (4.08% p.a.), but it came down significantly in Hamirpur (3.19% p.a.) during the overall period. Area put under fodder crops grew up in half of the districts with growth rates varying from 1.56 per cent per annum in Mandi to 7.15 per cent per annum in Hamirpur over the same period.

v. Compound Annual Growth Rates of Yield of Major Crops

An assessment of the growth rates of yield of major crops and crop groups at the state level showed that it grew up, though not significant for few of them, for majority of the crops during 1972-73 to 2004-05 (overall period) with the highest rate of growth registered by potato (4.21% p.a.). It was also evident from the growth behaviour of yield during the first[57] and second[58] period that productivity grew up mainly from 1988-89 onwards. As regards the districts, the yield of rice and maize increased in all the districts, though not significant for some of them, during the overall period, with the highest rate of growth witnessed in Una (3.55% p.a.) and Lahaul & Spiti (5.48% p.a.), respectively. However, considerable increase in the yield of rice and maize was observed primarily during the second period. While productivity of wheat grew up considerably in majority of the districts with the highest growth witnessed in Solan (2.41% p.a.), no significant increase was observed in the yield of barley during the overall study period.

[57] From 1972-73 to 1987-88.
[58] From 1988-89 to 2004-05.

The yield of 'other cereals' declined conspicuously in Chamba (7.38% p.a.) and Shimla (6.62% p.a.) during the first period; and Kullu (3.47% p.a.) and Mandi (2.85% p.a.) during the overall period. However, it grew up significantly in Kinnaur (1.72% p.a.) alone during the entire study period. Whilst the productivity of total cereals came down remarkably in Lahaul & Spiti (15.05% p.a.) during the first period, it grew up conspicuously in Kinnaur (3.25% p.a.) after 1988-89. But, over the entire study period the yield of total cereals increased in all the districts, except Lahaul & Spiti, with the highest rate of increase observed in Una (1.82% p.a.). As regards the yield of pulses, it declined considerably in majority of the districts during the first period with the highest decline observed in Solan (14.00% p.a.) while it grew up in most of the districts, though not significant for some of them, in the second period with Kinnaur recording the highest increase of 14.74 per cent per annum. Besides, the yield of foodgrains grew up in a vast majority of the districts during the overall period with Kullu witnessing the highest increase of 2.49 per cent per annum. Nonetheless, Lahaul & Spiti experienced substantial decline in the yield of foodgrains during first (14.02% p.a.) and second (6.99% p.a.) period of study. The observations revealed that during 1972-73 to 2004-05, productivity of potato increased considerably in most of the districts with annual growth rates varying from 3.14 per cent in Lahaul & Spiti to 10.84 per cent in Bilaspur. However, the hike in productivity was evident mainly from 1988-89 onwards. As far as the yield of oilseeds was concerned, while it declined substantially in majority of the districts during the first period with the highest rate of decrease witnessed in Kullu (13.76% p.a.), it registered upwards growth, though not significant for few of them, in most of the districts during the second period with Mandi experiencing the highest growth rate of 9.91 per cent per annum.

Broadly speaking, the analysis of growth performance of the yield of crops and crop groups studied revealed that most of them witnessed decline in productivity during the first period in majority of the districts. Contrary to this, a large number of districts experienced increase in the yield of majority of the crops and crop groups over the second period. However, during the entire study period, a vast majority of the districts witnessed upwards growth in the yield of most of the crops and crop groups considered in the study.

vi. Cropping Intensity

In relation to cropping intensity, it was found that it grew up at varying magnitudes both in the state and majority of the districts during 1972-73 to 2007-08. The increase in

cropping intensity was substantial in Chamba (38 per cent points), Kullu (37 per cent points) and Una (35 per cent points) but it came down drastically in Kinnaur (41 per cent points) and Shimla (25 per cent points) alone. However, it remained stagnant at around 104 per cent in the tribal district of Lahaul & Spiti. In the low hill districts (Hamirpur, Kangra and Bilaspur) and mid hill districts (Solan and Sirmaur) sharing border with plains the increase in cropping intensity was ranging from 9 to 17 per cent points. The highest value of cropping intensity index was, respectively, witnessed in Kangra, Bilaspur, Kullu, Bilaspur and Hamirpur during 1972-73, 1980-81, 1990-91, 2000-01 and 2007-08.

vii. Agricultural Diversification

The analysis of Herfindahl indices revealed that agriculture remained extremely diversified at the state as well as district level during 1972-73 and 2004-05. But, the increasing values of Herfindahl indices in the state and the districts of Bilaspur, Chamba, Hamirpur, Kangra, Kullu, Mandi, Solan and Una depicted a tendency towards specialization. Contrarily, the declining values of Herfindahl indices in Kinnaur, Lahaul & Spiti, Shimla and Sirmaur demonstrated a proclivity towards diversified agriculture. However, the values of Herfindahl indices were less than 0.5 for all the districts and the state. Whilst the pace of specialization was observed to be the highest in Hamirpur, it was the lowest in Kullu. The highest rate of diversification was recorded in Kinnaur whereas it was the lowest in Shimla.

As far as diversification of agriculture in terms of the share of area under non-foodgrains was concerned, it grew up by more than double both in per cent and absolute terms in the state during 1972-73 to 2004-05. It was found that diversification towards high value cash crops in most of the districts did take place during the study period but its intensity was quite pronounced in Kinnaur, Shimla, Lahaul & Spiti and Kullu where the increase in area under non-foodgrains was varying from 15.41 per cent points in Kullu to 34.55 per cent points in Kinnaur.

5.4.4. Irrigation Status

Irrigation was found to be one of the main factors hindering agricultural development in the state. Out of 542.60 thousand hectares of net sown area, only 103.93 thousand hectares (19.15%) received irrigation during 2004-05. Nonetheless, a marginal increase in irrigation extent was observed in the state from 16.83 per cent in 1974-75 to

19.15 per cent in 2004-05. As regards the districts though it went up in most of the districts but the increase was quite substantial in Kinnaur (33 per cent points), Una (17.79 per cent points), Solan (8.63 per cent points) and Sirmaur (8.45 per cent points). A decline was observed in the districts having *kuhl* irrigation as major source of irrigation (Shimla, Kangra and Kullu). While irrigation extent remained almost hundred per cent in Lahaul & Spiti, it was the lowest in Hamirpur during the study period.

Although irrigation intensity grew up in most of the districts, but the increase was very high in Una (64 per cent points), Solan (40 per cent points), Hamirpur (21 per cent points) and Sirmaur (15 per cent points) whereas the decline in irrigation intensity was very severe in Chamba (65 per cent points), Kullu (44 per cent points) and Mandi (10 per cent points) during 1972-73 to 2004-05.

5.4.5. Input Use in Hill Agriculture

The analysis of trends in fertilizers consumption in the state revealed that it increased continuously from 34.91 kg/ha to 55.87 kg/ha during the triennium endings 1992-93 to 2008-09 i.e. an increase of 60 per cent. Its use was, however, not balanced with the ideal ratio of fertilizers consumption. As regards the districts, fertilizers consumption grew up in most of the districts with the highest rate of increase witnessed in Shimla (175%), Kullu (94%) and Una (78%) while the lowest rate of increase was witnessed in Hamirpur (13%) during 1990-91 to 2008-09. Nevertheless, the highest level of fertilizers consumption was observed in Lahaul & Spiti in 1992-93 (114.63 kg/ha) and 2000-01 (73.67 kg/ha) whereas it was observed to be the highest in Shimla during 2008-09 (118.30 kg/ha). Whilst Chamba witnessed the lowest level of fertilizers consumption in 1992-93 (12.09 kg/ha) and 2008-09 (20.88 kg/ha), it was experienced by Kinnaur (14.54 kg/ha) during 2000-01. The ideal ratio of fertilizers consumption changed in majority of the districts in favour of nitrogen while it was benefiting neither nitrogen nor phosphorus in the remaining four districts.

As far as area under high yielding varieties of wheat, maize and paddy was concerned, it grew up substantially in the state both in absolute and per cent terms during the study period. The per cent area under high yielding varieties of wheat, maize and rice was the highest for wheat followed by rice and maize in 1976-77 whereas it was the largest for rice followed by wheat and maize in 2007-08.

Though farm mechanization is insufficient in the state, yet the extent of farm mechanization in terms of the number of agricultural implements per one thousand hectares of gross cropped area increased continuously from 1.543 machines per one thousand hectare of gross cropped area to 39.278 of that during 1972-73 to 2003-04.

5.4.6. Employment in Agriculture

It was observed that workers engaged in agriculture declined marginally from 70.80 per cent in 1981 to 68.65 per cent during 2001 in the state. The decline was substantial in case of male (10.44%) agricultural labourers than that of females (2.25%). As regards the districts, while Chamba, Kangra, Lahaul & Spiti and Kinnaur experienced increase in per cent share of workers involved in agriculture, being the highest in Chamba (4.49% points), it declined in rest of the districts with the highest decline witnessed in Solan (10.81 per cent points). The share of male agricultural workers grew up only in Kinnaur (4.16 per cent points) whereas it came down in the remaining districts with considerable decline observed in Solan (21.61 per cent points). Whilst the decline in per cent share of female agricultural workers was the highest in Shimla (4.84 per cent points), it increased conspicuously in Una (9.96 per cent points). The decline in the share of male agricultural labourers was higher than that of females in all the districts and the state. However, the highest share of workers engaged in agriculture was observed in Kullu whereas the lowest was seen in Lahaul & Spiti during the study period.

The analysis of agricultural work participation rates revealed that it grew up in the state from 24.33 per cent to 33.71 per cent during 1981 to 2001. While agricultural work participation rate of male population declined, that of females grew up considerably during the same period. The district level analysis of agricultural work participation rates revealed that it grew up at varying rates in all the districts over the study period from 1981 to 2001. Agricultural work participation rate was the highest in Kullu during 1981 (37.10%), 1991 (34.12%) and 2001 (44.61%) while it was the lowest in Una (15.74%) during 1981; and Kangra during 1991 (16.10%) and 2001 (28.00%).

5.4.7. Contribution of Agriculture to the State Economy

It was observed that, although, the value of total output originating from agriculture went up by more than double during the last three decades, its share in gross state domestic product (GSDP) declined continuously from 34.11 per cent in triennium ending 1982-83

to 14.41 per cent in triennium ending 2010-11. Likewise, the value of output generated in agriculture increased at the rate of 3.00 per cent per annum during the past three decades, but the rate of increase was higher from 1995-96 onwards (4.35% p.a.) as compared to ahead of that (2.59% p.a.). Contrarily, the share of agriculture in gross state domestic product diminished substantially with annual growth rate of 3.09 per cent during 1980-81 to 2010-11, but the rate of decline was substantial from mid 1990s onwards (2.68% p.a.) than prior to that (2.45% p.a.).

5.4.8. Agricultural Development

As regards the levels of agricultural development across districts, it was found that all the three methods classified Lahaul & Spiti, Solan, Sirmaur and Kangra as agriculturally more developed districts during 1991-92. The same districts were put in this category during 2004-05 with a minor change where Mandi replaced Sirmaur. Likewise, all the methods categorized Chamba and Kullu as agriculturally less developed districts in 1991-92. In addition to these two districts, Hamirpur was put in this class during 2004-05.

Based on all the three methods of determining the levels of agricultural development, agriculturally more developed and less developed districts in 1991-92 almost remained as more developed and less developed during 2004-05 with very small changes such that Mandi replaced Kinnaur in the ranking method, Sirmaur exchanged position with Mandi in the indexing method and Una substituted Hamirpur in case of agricultural development index method. But the rank positions of the districts did change for most of them during 1991-92 to 2004-05.

As regards the inter-district disparities in agricultural development, the districts were diverging in relation to eight indicators while they were on the converging mode with regard to the remaining seven indicators of agricultural development considered. Among the indicators witnessed convergence, magnitude of other fallow land, fertilizer consumption and net sown area per cultivator depicted considerable decline in inequalities by 95.68 per cent, 13.78 per cent and 11.50 per cent, respectively. Contrarily, the disparities among the districts with respect to area under high yielding varieties of major crops, number of agricultural credit cooperatives per 1000 cultivators and magnitude of culturable waste land widened substantially by 35.88 per cent, 17.35 per cent and 13.26 per cent, in that order.

5.5. Conclusions and Policy Implications

1) Area under non-agricultural uses increased at a very high rate especially during 1990s and onwards. Most of the increase came from net sown area that declined drastically during this period. Increase in the magnitude of culturable wastes and other fallows were also responsible for reduction in net sown area. This has important policy implications for the sustainability of agricultural development and food security in the state.

2) The observations revealed that the size of land holding is becoming smaller and smaller, and marginal farmers are growing rapidly in the state. It could be a big hindrance on the way towards commercial agriculture as well as a threat to the sustainability of livelihood of farming families in the hilly areas. This calls for devising extensive plans that are guided by proper development policies to address this important issue in the hilly areas.

3) Although, the yields increased for most of the crops during the second period in the state, yet it was significant only for a few crops. Also, the productivity level was very low. Decrease in net sown area can be, *inter alia*, corrected by improving the yield of crops. Thus, policy should aim at increasing productivity so as to improve livelihood of farmers, ensure food security and meet market needs.

4) Area under non-foodgrains grew up at varying rates in most of the districts which implies a move towards market oriented agriculture. Because of small size of holdings and increasing number of marginal farmers, the policy should be manipulated in such a way that benefits marginal and small farmers and does not jeopardize food security.

5) Irrigation was observed to be the great challenge to agriculture in the state as only 19.15% of its net sown area received irrigation during 2004-05. Since the state is endowed with plentiful water resources, policy should be guided towards better utilization and sustainable management of water resources.

6) Fertilizer consumption increased at varying magnitudes in most of the districts but its use is still very low. The ideal ratio of fertilizer consumption (4:2:1) changed either in favour of only nitrogen or against both nitrogen and phosphorus. Thus, to

increase agricultural productivity and improve soil fertility, definite plans and policies are required to encourage the balanced fertilizers use.

7) Although, agricultural mechanization grew up in the state but it is still insufficient. It was primarily confined to the southwest submontane regions where land is mostly flat and less undulated. Thus, efforts are needed to increase the extent of mechanization and its spread across the districts in the state.

8) Employment in agriculture diminished over the study period, but the rate of decline was higher for males than that for females. Hence, policy should aim at creating more on-farm, off-farm and out-farm employment opportunities so as to reduce the pace of labourers' exit from agriculture and unemployment.

9) Determining the levels of districts' agricultural development revealed that the rank position recorded by any district is directly proportionate to its accomplishments as measured by the indicators of agricultural development considered. Therefore, these indicators can serve as the macro and micro policy variables for manipulating agricultural development in these districts.

10) The disparities in agricultural development were evident among the districts. Hence, to reduce the inequality, policy makers and planners must think of providing enabling environment and equal opportunities in all the districts so as to ensure balanced agricultural development across the districts.

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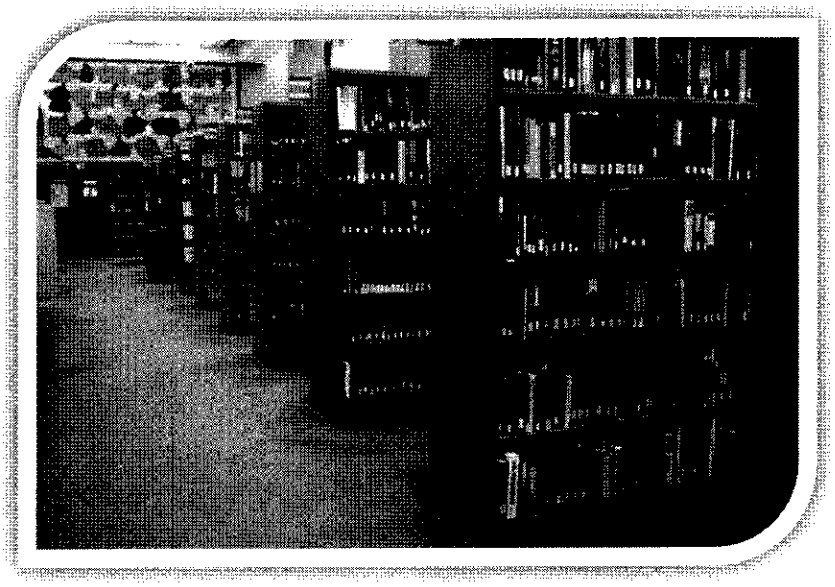

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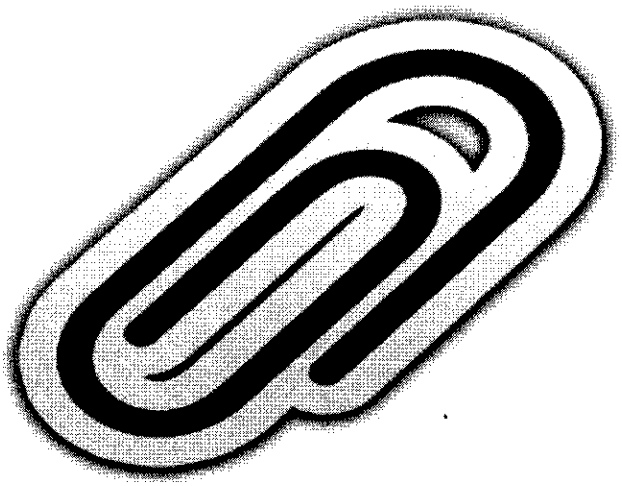
Appendices



Appendix 1

Indicators of Agricultural Development Used in Determining the Levels of Agricultural Development in Himachal Pradesh, 1991-92.

Sr. No.	Districts	Positive Indicators													Negative Indicators	
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
1	Bilaspur	37.28	198.34	190.48	3.68	1.08	1.59	0.40	48.04	9.17	0.51	0.68	1.19	69.10	4.28	0.84
2	Chamba	12.09	116.44	156.34	7.60	0.88	1.78	0.29	45.47	13.83	0.48	0.63	1.53	66.32	0.84	0.04
3	Hamirpur	35.05	182.05	194.96	1.04	1.11	1.62	0.43	45.18	4.68	0.56	0.75	3.25	71.46	8.31	0.36
4	Kangra	31.48	193.73	181.29	10.88	0.94	1.54	0.28	46.85	27.16	0.70	0.85	3.53	75.17	8.01	0.94
5	Kinnaur	13.58	118.16	120.83	23.78	1.48	0.80	0.31	53.81	57.22	0.39	0.93	1.90	72.88	0.82	0.14
6	Kullu	31.64	100.00	175.34	16.96	0.78	1.77	0.23	71.19	6.56	0.36	0.44	1.25	63.10	6.31	0.60
7	Lahaul & Spiti	114.63	102.95	106.25	63.60	1.62	2.11	0.26	47.42	98.50	0.37	0.91	5.93	86.47	0.31	0.05
8	Mandi	29.38	189.78	171.76	7.45	0.95	1.51	0.28	61.58	14.12	0.45	0.44	1.00	83.73	1.08	0.07
9	Shimla	42.98	158.89	142.63	28.12	1.40	1.45	0.18	56.25	5.96	0.47	0.71	1.07	80.58	2.42	0.34
10	Sirmaur	27.14	188.34	186.21	12.30	2.28	1.88	0.26	64.78	32.82	0.39	0.42	1.08	73.46	5.86	0.46
11	Solan	41.14	168.61	165.11	10.38	1.85	1.64	0.29	44.26	23.61	0.55	0.99	2.19	68.06	6.78	0.37
12	Una	54.20	180.84	168.63	8.16	1.39	1.50	0.38	50.38	13.21	0.76	0.79	3.86	58.13	6.92	5.99

Note: The same indicators and data were used in measuring the inter-district disparities in agricultural development.

X_1= Fertilizers consumption (kg/ha), X_2=Irrigation intensity (%), X_3=Cropping intensity (%), X_4=Area under non-foodgrains (%), X_5=Average size of holding (ha), X_6= Productivity of foodgrains (t/ha), X_7=Agricultural diversification index (H.I.), X_8=Workers engaged in agriculture (%), X_9=Net irrigated area as percentage of net sown area (%), X_{10}=Net sown area per cultivator (ha/cultivator), X_{11}= Number of commercial banks per 1000 cultivators, X_{12}= Number of agricultural credit cooperatives per 1000 cultivators, X_{13}= Area under high yielding varieties (HYVs) of major crops (%), X_{14}= Magnitude of culturable waste land (%), X_{15}=Magnitude of other fallow land (%).

Also note that the data pertaining to X_1, X_5, X_{12} and X_{13} correspond to the year 1992-93, 1995-96, 1998-99 and 1992-93, respectively.

Appendix 2

Indicators of Agricultural Development Used in Determining the Levels of Agricultural Development in Himachal Pradesh, 2004-05.

Sr. No.	Districts	Positive Indicators													Negative Indicators	
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
1	Bilaspur	36.58	193.74	187.75	2.85	0.92	1.70	0.44	70.28	10.48	0.27	0.38	0.64	100.00	5.55	1.13
2	Chamba	15.79	120.48	158.00	8.42	0.79	1.79	0.30	73.44	13.54	0.25	0.32	0.77	26.70	0.90	0.03
3	Hamirpur	36.62	198.36	197.46	1.17	1.01	1.62	0.46	71.48	4.81	0.25	0.39	1.53	96.73	9.53	1.66
4	Kangra	38.91	188.01	185.92	10.07	0.89	1.43	0.29	63.65	29.92	0.35	0.46	1.79	98.99	4.77	0.11
5	Kinnaur	17.35	125.55	121.33	49.29	1.37	1.21	0.22	67.09	59.76	0.25	0.61	1.13	0.00	0.57	0.02
6	Kullu	48.06	102.38	179.28	21.87	0.63	1.65	0.24	78.63	7.77	0.23	0.31	0.77	75.57	5.66	0.40
7	Lahaul & Spiti	95.18	105.98	106.06	74.43	1.54	0.79	0.30	54.53	99.76	0.30	0.72	4.66	100.00	0.07	0.00
8	Mandi	39.38	183.24	185.16	10.40	0.86	1.84	0.28	73.96	16.09	0.26	0.31	0.66	100.00	1.12	0.06
9	Shimla	89.81	180.54	138.88	51.49	1.13	1.36	0.19	66.80	3.44	0.29	0.55	0.65	31.41	2.67	0.98
10	Sirmaur	35.29	188.50	183.74	20.85	2.02	1.75	0.23	74.10	34.27	0.26	0.30	0.74	73.92	6.94	1.07
11	Solan	52.92	184.39	164.97	13.84	1.73	1.63	0.28	56.91	25.28	0.27	0.55	1.07	99.99	7.57	0.63
12	Una	79.82	176.80	194.84	8.89	1.29	1.88	0.39	62.73	21.91	0.35	0.47	1.87	96.94	13.64	1.57

Note: The same indicators and data were used in measuring the inter-district disparities in agricultural development.

X_1= Fertilizers consumption (kg/ha), X_2=Irrigation intensity (%), X_3=Cropping intensity (%), X_4=Area under non-foodgrains (%), X_5=Average size of holding (ha), X_6= Productivity of foodgrains (t/ha), X_7=Agricultural diversification index (H.I.), X_8=Workers engaged in agriculture (%), X_9=Net irrigated area as percentage of net sown area (%), X_{10}=Net sown area per cultivator (ha/cultivator), X_{11}= Number of commercial banks per 1000 cultivators, X_{12}= Number of agricultural credit cooperatives per 1000 cultivators, X_{13}= Area under high yielding varieties (HYVs) of major crops (%), X_{14}= Magnitude of culturable waste land (%), X_{15}=Magnitude of other fallow land (%).

Also note that data pertaining to X_5, X_8, X_{10}, and X_{12} correspond to the year 2005-06, 2001-02, 2001-02 and 2007-08.

Appendix 3

Gross State Domestic Product (GSDP) and GSDP Originated from Agriculture Sector at Factor Cost at 2004-05 Prices in Himachal Pradesh, 1980-81 to 2010-11.

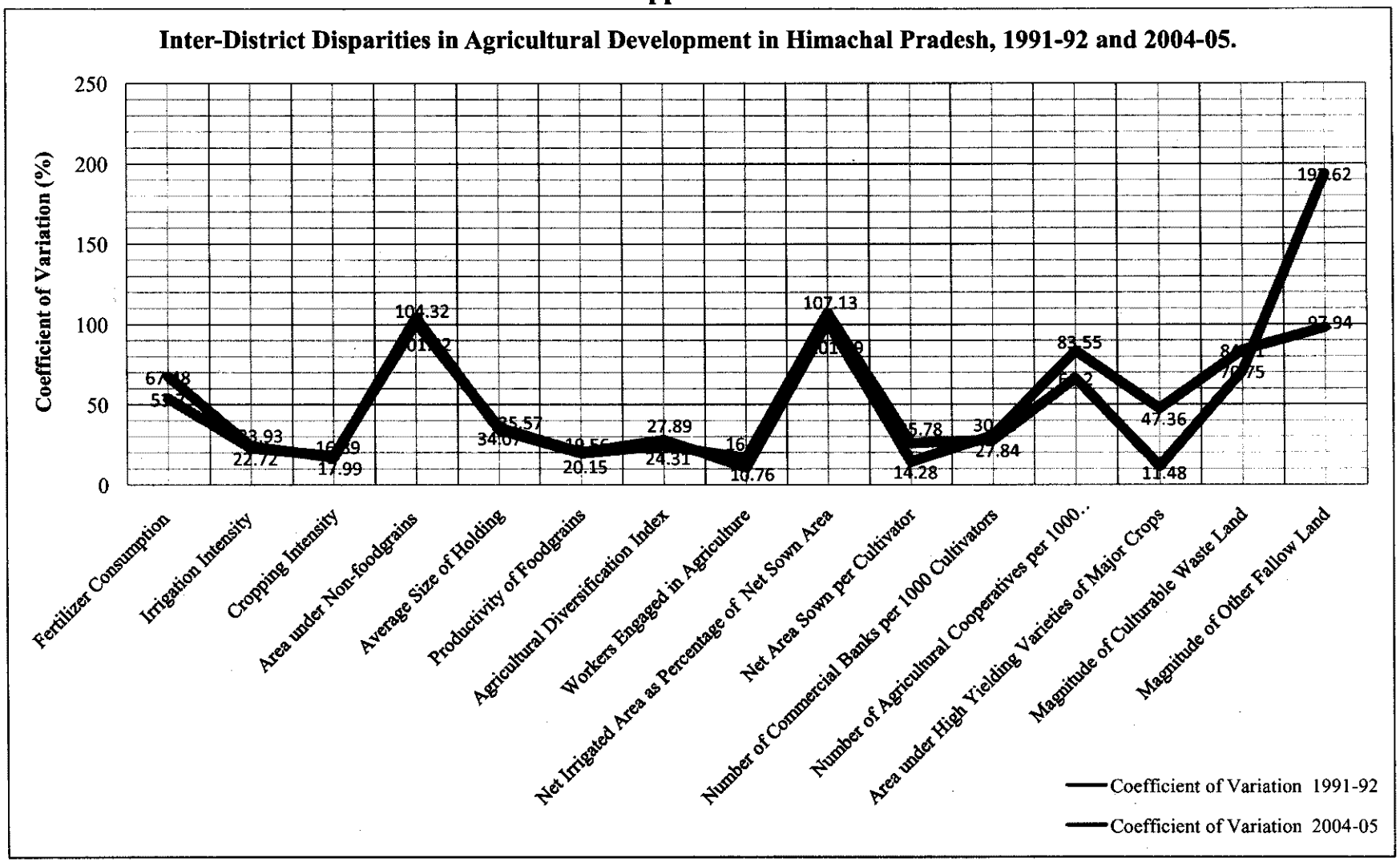
(Rs. Lakh)

Years	Gross State Domestic Product (GSDP)	GSDP Originated from Agriculture Sector
1980-81	650698	227511
1981-82	689558	244289
1982-83	670554	214058
1983-84	705374	248478
1984-85	667006	228220
1985-86	759058	260057
1986-87	812168	283802
1987-88	819503	240687
1988-89	921323	258631
1989-90	1014235	332075
1990-91	1053332	320471
1991-92	1057053	306879
1992-93	1116432	304361
1993-94	1163888	299929
1994-95	1276136	298766
1995-96	1355112	311741
1996-97	1449246	315430
1997-98	1541687	315905
1998-99	1652859	325967
1999-00	1762238	309463
2000-01	1873591	368639
2001-02	1971225	402507
2002-03	2070947	412265
2003-04	2238313	467047
2004-05	2407658	*474739*
2005-06	2610733	494412
2006-07	2848060	469258
2007-08	3091672	525123
2008-09	3319192	516079
2009-10	3588814	458219
2010-11	3911186	584632

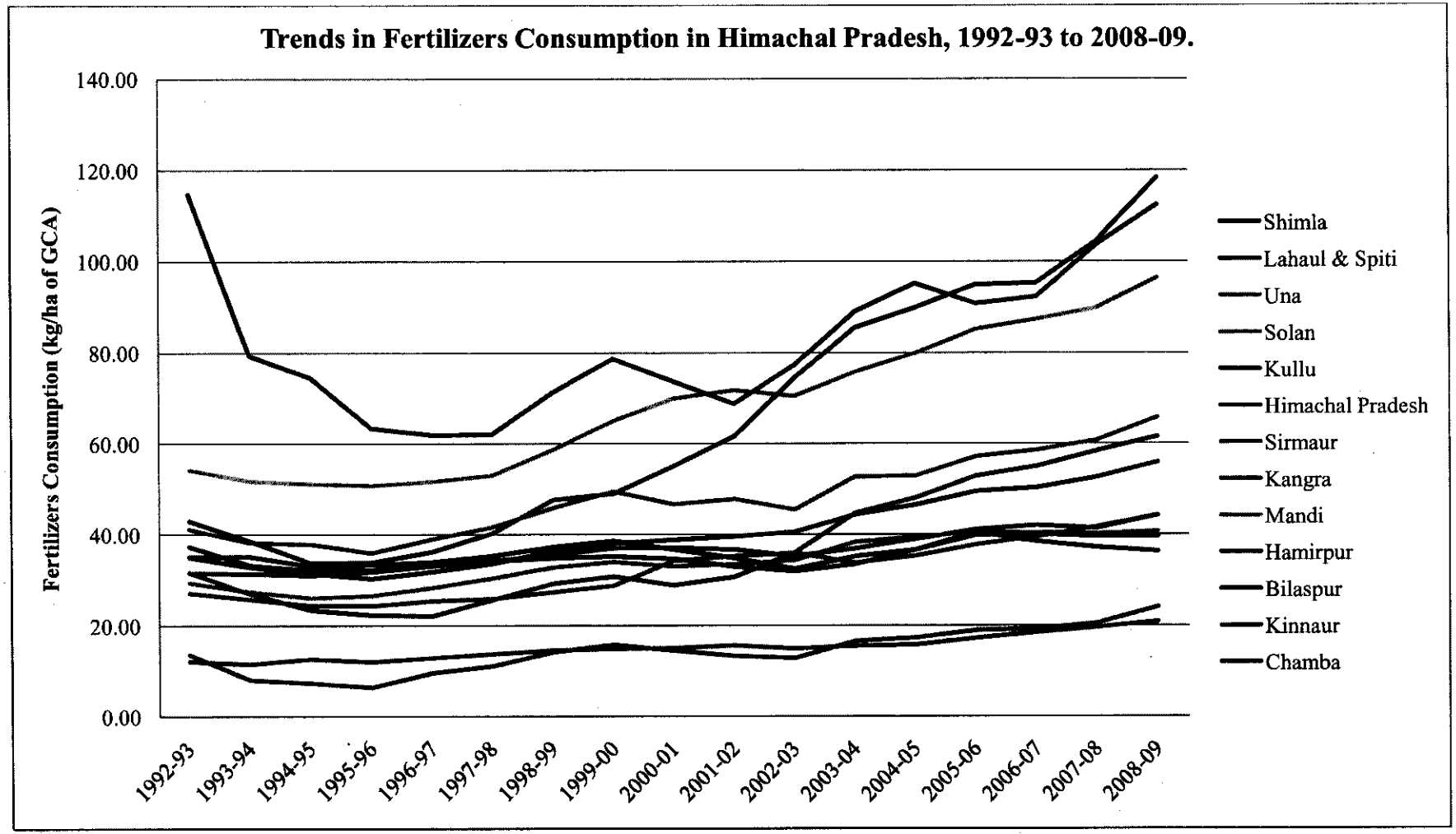
Note: The data presented in the table were spliced to the common base of 2004-05.

Appendix 4

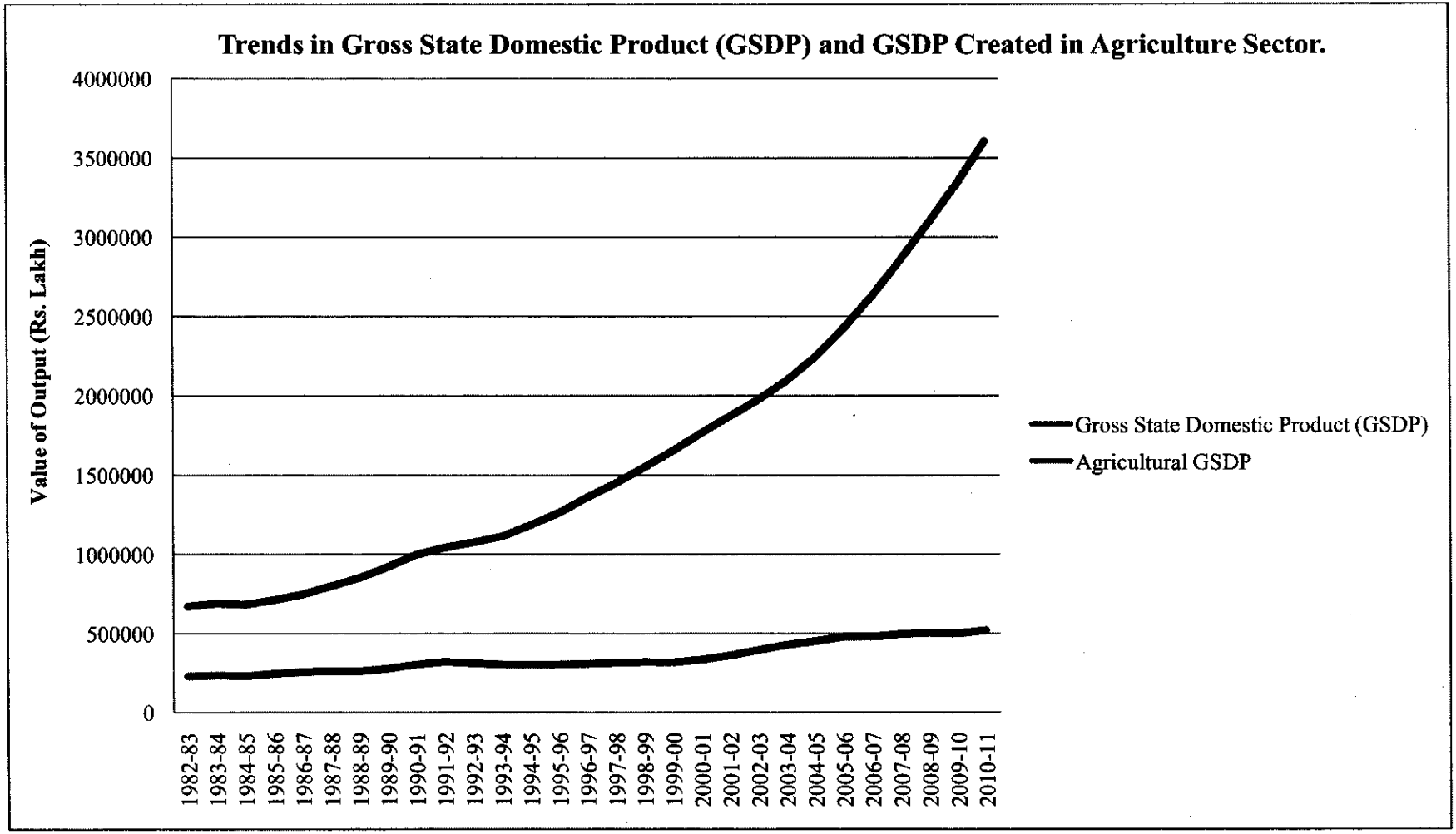
Inter-District Disparities in Agricultural Development in Himachal Pradesh, 1991-92 and 2004-05.



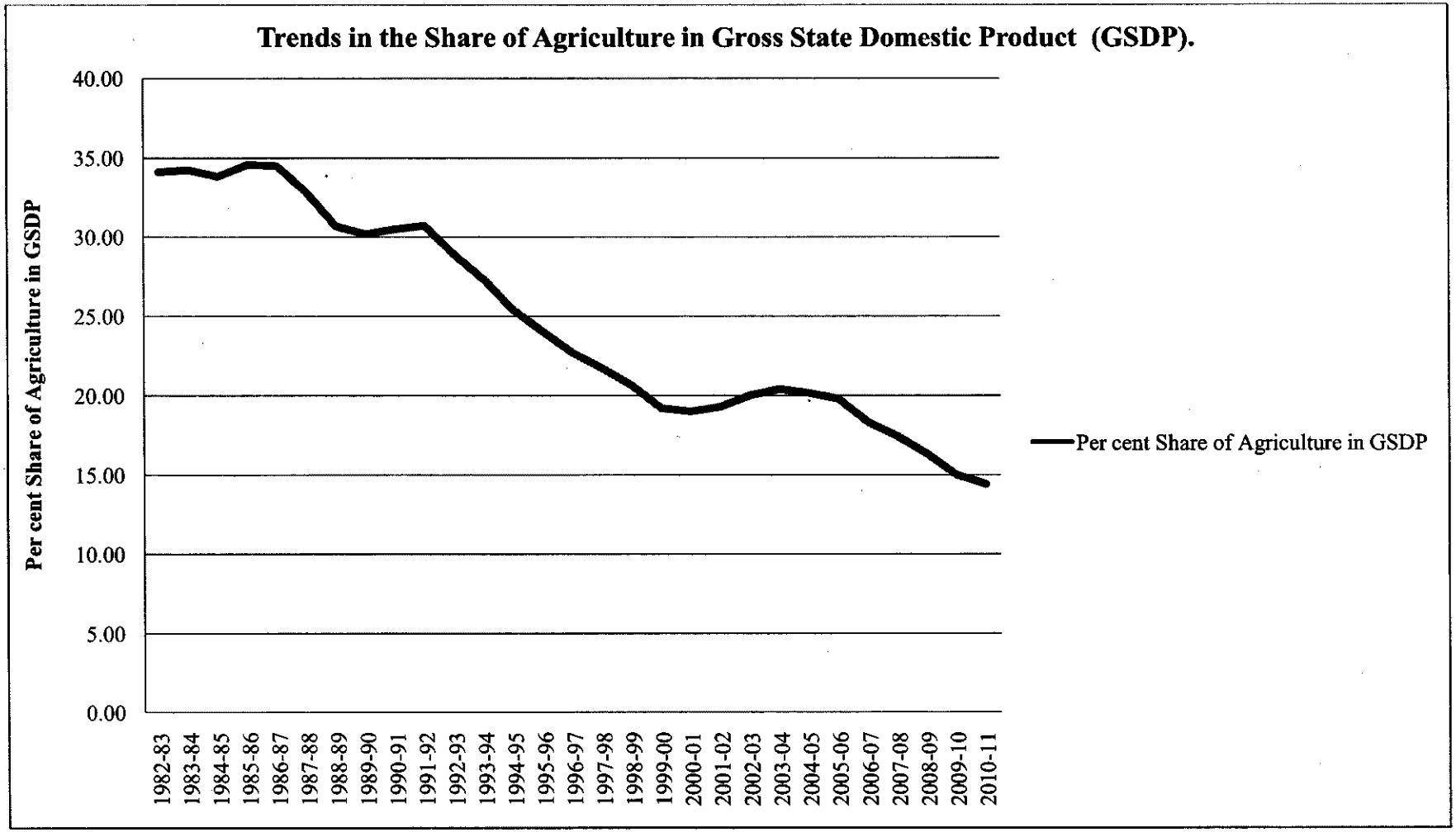
Appendix 5


Trends in Fertilizers Consumption in Himachal Pradesh, 1992-93 to 2008-09.
Fertilizers Consumption (kg/ha of GCA)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
Shimla
Lahaul & Spiti
Una
Solan
Kullu
Himachal Pradesh
Sirmaur
Kangra
Mandi
Hamirpur
Bilaspur
Kinnaur
Chamba

Appendix 6


Trends in Gross State Domestic Product (GSDP) and GSDP Created in Agriculture Sector.
Value of Output (Rs. Lakh)
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
1982-83
1983-84
1984-85
1985-86
1986-87
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
Gross State Domestic Product (GSDP)
Agricultural GSDP

Appendix 7


Trends in the Share of Agriculture in Gross State Domestic Product (GSDP).
Per cent Share of Agriculture in GSDP
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1982-83
1983-84
1984-85
1985-86
1986-87
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
Per cent Share of Agriculture in GSDP

Appendix 8

Modification of Ranking Method for Assigning Rank Scores to Negative Indicators

The idea is that in case of negative indicators, the lowest value is perceived as the best performance and *vice versa.* Thus, the lower values should get higher rank score and *vice versa.* Ascending order means going from smaller to bigger, that is, give rank score 1 to the lowest value and rank score 12 to the largest value of an indicator which was in no way applicable to assign rank score to the negative indicators. Descending order means going from bigger to smaller, that is, give rank score 1 to the largest value and rank score 12 to the lowest value of an indicator. Hence, descending order was considered as the most appropriate way of assigning rank score to the negative indicators. For more clarifications see the following example.

Table 1 Assigning Rank Scores in Ascending Order (Positive Indicator)

Indicator	Rank Score
37.280	8
12.090	**1**
35.046	7
31.479	5
13.582	2
31.641	6
114.627	**12**
29.382	4
42.980	10
27.143	3
41.144	9
54.196	11

Table 2 Assigning Rank Scores in Descending Order (Negative Indicator)

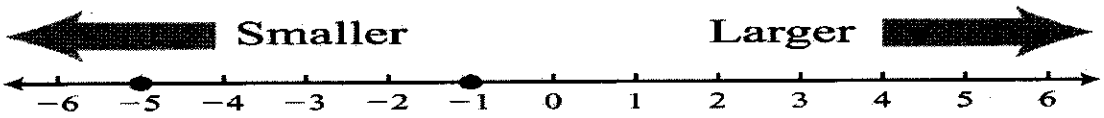
Indicator	Rank Score
4.281	7
0.838	10
8.306	**1**
8.011	2
0.822	11
6.308	5
0.309	**12**
1.084	9
2.421	8
5.857	6
6.777	4
6.917	3

Appendix 9

Modification of Indexing Method for Assigning Index Scores to Negative Indicators

As explained in the preceding *appendix* negative indicators consider the lowest value of an indicator as the best performance and *vice versa.* Thus, the lower values should get higher index score and *vice versa.* The modification was based on the simple principle of number line (*see Fig. 1*). Accordingly, the number (s) to the right is always greater than the number (s) to its left. For example: 6 > 4, 0 > -1, -2 > -6 and so on.

Fig. 1 The Number Line.



Using this principle, the modification was done by changing the sign of index scores of the negative indicators for all the districts from positive to negative. For this, the values of the indicator were divided by the negative of its corresponding state average. The following table presents an example for further illustration.

Table 1 Assigning Index Score to the Negative Indicators.

Negative Indicator	Index Score Before Modification	Negative Indicator	Index Score After Modification
5.546	112.828	5.546	-112.828
0.900	18.316	0.900	-18.316
9.528	193.854	9.528	-193.854
4.769	97.034	4.769	-97.034
0.566	11.525	0.566	-11.525
5.655	115.061	5.655	-115.061
0.066	**1.340 (smallest)**	**0.066**	**-1.340 (largest)**
1.123	22.845	1.123	-22.845
2.669	54.310	2.669	-54.310
6.942	141.229	6.942	-141.229
7.573	154.081	7.573	-154.081
13.643	**277.577 (largest)**	**13.643**	**-277.577 (smallest)**
$Index\ Score = \frac{Value\ of\ Indicator}{State\ Average} \times 100$ **Note: State Average = 4.915**		$Index\ Score = \frac{Value\ of\ Indicator}{-ve\ (\text{State Average})} \times 100$ **That is,** $Index\ Score = \frac{Value\ of\ Indicator}{-4.915} \times 100$	