

Farmers and Farming: Punjab at crossroads

***An attempt to understand trends of agriculture in the northern
Indian state of Punjab***



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**Master thesis
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Dedication

This Research Work is Dedicated to

The Almighty GOD

And

My

Loving parents

Declaration

I hereby declare that this Research study is a result of my own work and effort. It has not been presented in part or in whole to any institution or organisation for the award of any merit. All sources of information used have been duly acknowledged.

.....

Malhi, Bharatdeep Singh.

Acknowledgement

I find it as a privilege to record my deep sense of gratitude and heartfelt sincere thanks to my esteemed and worthy guide and Supervisor ***Prof Haakon Lein***, Dept of Geography, NTNU, for his inspiring guidance, vital suggestions, constructive criticism, keen interest and constant supervision throughout the field work which led to the successful completion of this research.

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Last but not the least, I appreciate and thank all those who contributed either directly or indirectly to this work. I say thank you to you all and may GOD bless you.

I wish to state that all shortcomings, omissions of this study, are entirely my own responsibility.

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Malhi, Bharatdeep Singh

Abstract

Punjab, a modest-sized state tucked away on the north-western border of India, is often known as the bread basket of India. Huge grain surpluses produced by its farmers since the green revolution helped the country gain self-sufficiency in food. But there is growing perception in the sense of uncertainty regarding what the future holds for the state. After a spectacular growth rate during the sixties and the seventies, Punjab's economy has decelerated during 1990's. The state wonders whether the younger generation will grow in the most affluent and developed state in the country as their parents once did. Will the heady days of the 'green revolution' ever return to Punjab?

Such anxieties are not without reasons: there is stagnation in agriculture which is the most dominant factor in the states economy as the result Punjab, presently is one of the slowest growing Indian states. The agricultural practices in the state seem to be increasingly becoming environmentally unsustainable. The stellar growth of monocultural pattern of wheat and rice has resulted in manifestations of several adverse effects like groundwater exploitation, soil degradation. The stagnation in agriculture has also resulted in various socio-economic problems.

The primary reasons of stagnation were found to be over dominance of wheat and rice cropping system, over investment in agricultural machinery, over dependence on migrant labour besides some attitudinal changes in the behaviour of the farmers. The major agricultural institutions of the state seemed to be lacking in extension services and clear policies about agriculture. The farm size is decreasing, thus making agriculture non profitable for small farmers. Farmers are facing problems due to lack of infrastructure facilities in agricultural setup.

Agricultural diversification should be encouraged to reverse the trends. Government should encourage industrialization and investment in agro-processing industries. This study defines the present problem as the result of all the three participating actors in state's agriculture; farmers, agricultural university and the government. The conviction of this study is that proper policies should be put in place to help farmers bail out of the present agricultural crises. If the coordination between these three is established, it can go a long way in turning Punjab's uncertain future into promising outlook as once existed.

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Abbreviations

CIMMYT--- International Maize and Wheat Improvement Centre

FAO—Food and Agricultural Department of United Nations

FCI--- Food Corporation of India

KVK---Krishi Vigyan Kendra

MSP--- Minimum Support Price

PAU--- Punjab Agriculture University

PAFC---Punjab Agro Food Grain Corporation

PSCST--- Punjab State council for Science and Technology

Chapter One

General Introduction

1.0 General Background

Punjab is India's most prosperous and developed state with one of the lowest poverty rate's in the country. At the end of the 1990's, more than 94 percent of Punjab's citizens were above the poverty line, 70 percent were literate, 94 percent of the six year olds were enrolled in primary schools, and 72 percent of the children fewer than twelve months were immunized. 99 percent of households had access to safe drinking water, and the average life expectancy was 68 years (Punjab development report, 2004). Its remarkable development record can also be inferred from the fact that it has already achieved, or is well on the track to achieve, most of the millennium development goals. According to India's national human development report, Punjab was ranked second only to kerela in terms of the overall level of human development among the major Indian states. Most citizens of Punjab have thus already achieved the level of socio – economic status that the majority of Indian citizens are unlikely to experience in their lifetime.

Yet there is a sense of uneasiness regarding what the future holds for Punjab. Concerned citizens of the state wonder whether the younger generation will grow up in the most affluent and developed state in the country like their parents and grandparents once did. Will the heady days of the green revolution ever return to Punjab? Will the state be able to hold on to the impressive gains made on the socio – economic front? Such anxieties are not without reason: the state's public finances are under severe stress, the economy has stagnated, employment opportunities are shrinking and human development indicators are beginning to languish or even deteriorate.

With the advent of high yielding, input-responsive dwarf varieties of rice and wheat during 60's, the entire agriculture production system in Punjab got revolutionized. Major shifts were witnessed in the cropping pattern, especially, in irrigated ecosystems where cereal based multiple cropping came into prominence, relegating less productive, risk prone legumes and oilseed crops to marginal lands. The farmers found the rice - wheat cycle most profitable. Consequently, they abandoned other crops such as pulses, mustard, vegetables, etc. The practice resulted in depletion of organic content and plant nutrients in the soil. The farmers

are now compelled to use more and more chemical fertilizers and other inputs to achieve the same production level. The law of diminishing returns has set in. There are indications of significant changes in the natural resource base e.g. falling ground water table over large portions of the state, water logging in the south-western part, degradation of soil health (loss of organic carbon and deficiency of micro and secondary nutrients like zinc, manganese, iron and sulphur) and severe soil erosion in the sub-mountainous Kandi belt in the eastern part of the state (Sondhi and Khepar, 1995).

It is not only those ecological characteristics that are changing but it has much wider prospective which needs to be studied. My concern is to study the prospective of agriculture including the recourses involved. Any discussion with regard to agriculture is incomplete without including the perspectives of ecology and economy. Social aspect can also not be ignored. In the state of Punjab, the problem of stagnation in agriculture cannot be seen as independent problem. It must be carefully studied to know the interrelationship and importance of all the factors which might play a crucial role.

Natural recourses are the wealth supplied by nature, available for human use, including energy, soil fertility, groundwater, forests etc. Of particular importance to this research work are the renewable resources, specially land, soil and groundwater. Renewable recourses are those that naturally regenerate to provide new supplies within certain time span. They are renewable, and are being always available, but open to human modification is that they may be depleted, sustained or increased through human activity. Examples of these kinds of resources include the organic resources, which are capable of reproducing themselves, and are clearly affected by human action like soils, groundwater etc. However resources like soils can take much longer time to regain its fertility or original characteristics.

The major issues of agriculture in Punjab involve perceived resource degradation, declining socio - economic development of the farmers. Agriculture is the dominant sector in Punjab (about 45 percent of the GDP) but over the last decade the growth in this sector has been much less than in the eighties. About 70 percent of the people in Punjab have agriculture as their main source of income and livelihood (refer to url¹ on page 110).

Land is an important asset to the agriculture in Punjab. Its fertility makes it one of the most productive lands in the country. With nearly maximum use of the agricultural land, the pressure on land has already increased. The growing population is also adding to the pressure.

It is of extreme importance to preserve the productivity of agricultural land because if exhausted can have grave consequences. Soil forms another important element of the agricultural system, as its fertility determines the production levels. Last but not the least, groundwater is of equal importance to the agriculture and thus to the economy of the farmers of Punjab. Various studies indicate that the ground water table is dropping alarmingly in the state, which could bring daring results for the survival of the farmers and farming in the state.

It must be noted that natural resource management is reflected in land use patterns or systems. But land use systems are characterised by variability in time and space and various socio – economic and biophysical factors interact at different levels (Blaikie and Brookfield, 1987; Reenberg, 1995b). In order to determine the actual reasons of agricultural stagnation, it is essential to understand, the socio – economic, biophysical and institutional factors involved. In addition to these vital roles of resource utilization, planning and management requires to be evaluated at the local level. It is in line with these, that the study attempts to explore the causes of stagnation and the relationship between these elements in Punjab. It focuses on the role of agricultural institutions in managing the farmers and farming of the state.

The starting point is recognition that agriculture and ecosystems are inherently linked. Composed of the same resources like land and water, they are based on the same biological processes, photosynthesis and biomass production. Agriculture is itself an ecosystem from which humans appropriate primary and secondary products, and the history of agriculture can be seen as the increasing control of biological processes for the purpose of increasing production.

In order to exploit the opportunities for harmonizing agriculture and ecosystems in future development initiatives should include three major components as been listed as requirements for optimum agricultural system

According to (FAO, Agricultural Department), first component is *Knowledge*. The interactions and interdependencies between agriculture and ecosystems are numerous, location specific and characterised by the complexity of their biophysical mechanisms. This requires us to acquire a broader knowledge of these interactions and processes. Then comes *Values*, in making strategic decisions for development and the use of natural resources such as water, we need to be guided by criteria that attribute the right value to food and environmental

services, above all in water systems that serve multiple purposes. These values are in part, but not exclusively, economic. The last component but very important is the *Institutions*, We need an enabling environment to achieve coherence in national and state policies, as well as in local natural resources management arrangements. Local stakeholders - above all, farmers and resource users - and state government need to be fully engaged.

Applying an ecosystems approach to agriculture means focusing on its optimization within its ecological surroundings, i.e. to regard the agricultural sub-system as a part of the wider ecosystem. So the need of the hour is the integrated approach in resource management that focuses on multiple services. The 1992, Earth Summit in Rio de Janeiro emphasized that agriculture and the environment must be synergistic and defined Integration as looking for mutual services across the "traditional" division of production and environment.

Coherence in the policies is also very important because reality is often such that at the policy level the problems and the opportunities are not timely analysed and generalized. Coherence in the cross-sectoral policies is essential to support collaboration among stakeholders. Policy Coherence in agriculture can be made with involvement of major stakeholders, in case of agriculture, government and farmers. The emphasis in these kinds of policies is on environment, economic upliftment and human development.

All the above discussed factors constitute the basis of this study. Upon these components are based the aims and objectives which are analysed in respect to the state of Punjab. The next section outlines the main research problem, objectives and scope of the study.

1.1 Research Problem

Punjab, the granary of India, has played a historic role in transforming India from a nation that was food deficient to one that is self-sufficient. The turnaround was so dramatic and achieved in a very short time that it was called a revolution.... the green revolution.

The Punjab state with only 1.53 % of geographical area of the country has been contributing major proportions of wheat and of rice of the national food reserves during the last three decades.

Since the 1980's, however the colour has been fading. After attaining an exemplary growth in production, Punjab agriculture has reached at the crossroads from where sustaining growth

appears to be an arduous task. Many observers on agriculture issues in Punjab paint a picture of decay and degradation of agricultural system. Most of the experts have expressed persistent concerns and focus regarding the margin of profit from major crops and farm size etc.

The depletion of ground water, degradation of soil health and soil texture, deterioration of ecology and environment are other very serious challenges that Punjab agriculture is facing.

Punjab's agrarian economy today stands at crossroads. The majority (nearly 80%) of the cultivators and all the agricultural labourers are beleaguered by stagnation. About 15 to 18 percent of the Punjab farmers have already been pushed below the poverty line (Joginder et al, 1997). The existing cropping pattern and crop-technology offer no solution to these problems.

This has lead to stagnation in agriculture, the only source of income for the people of the state. This challenge which agriculture faces today is also bound to have social effects.

In fact, Punjab agriculture has reached a stage where its viability and sustainability is in doubt. Being mainly an agricultural economy, the result of stagnation has led to overall slowdown in the development of the state. After a spectacular growth rate during the sixties and the seventies, the Punjab economy began to slow down in the late 1980's and decelerated further during the 1990's. Its per capita income grew at an annual average rate of 2.1 percent during the 1990's – significantly below the national average and the third lowest growth rate among the major Indian states. Much of the growth slowdown originated from the agricultural sector – its output grew at a trend rate of 2.6 percent per annum in 1990's compared to the all Indian average of 3.2 percent and almost half of the growth rate of 5 percent per annum in the 1980's (Punjab statistical report, 1999). Thus, the Punjab farm economy has reached at a stage rendering the fate of large agricultural population in doldrums.

The green revolution led to dramatic increases in agricultural production and radically transformed the course of Indian agriculture. Nowhere was this truer than in the state of Punjab, where the new high yielding varieties (HYV's) of wheat and rice were first and most intensively adopted. From 1965 to 1973, production of wheat, the primary winter (Rabi) crop, increased at an annual rate in excess of 7 percent. Rice, which was not widely grown prior to the green revolution, grew at a remarkable rate of 18 percent during this period. Overall agricultural production increased at a rate of 6 percent (Joginder et al, 1997).

This record growth in production has led many economists to believe that productivity growth must have also been high in Punjab's agricultural sector. More recently, in the years following the green revolution, there has been growing concern that high rates of productivity growth have been sustained, in the light of heavy water and fertilizer inputs, diminishing growth in yields of the major crops, and degradation of the water and land resource base.

Owing to near stagnation in yield, the per hectare return on land in wheat continues to decline. The per annum trend growth rate of return from wheat and paddy together, over variable cost, declined from 2.90 percent during 1980's to -2.18 percent during 1990's. Clearly, there was 5.08 percent less growth of return from wheat and paddy during 1990's compared to 1980's. (Joginder et al, 1997).

The ever-decreasing size of net sown area per agricultural worker (from 2.2 hectares in 1960-61 to 1.1 hectares in 1997-98), has further aggravated the problems of Punjab agriculture and farmers in particular and that of Punjab economy in general. This characteristic among others have resulted in grave economic fallouts for the farmers. In fact, Punjab agriculture has reached a stage where its viability and sustainability is in doubt.

The ecological and economic problems related to agriculture are numerous, but it appears that the greatest concerns today are the issues of cropping pattern and resource degradation, which manifest it in various forms and with varied and complex results leading to social implications also. All these problems relate to unsustainable utilisation of agricultural resources and also indicate that there is either absence or lack of co ordination of government development plans in the agricultural sector.

Agricultural stagnation has lately become frequently used word in agricultural institutions and policy makers. Often farmers are blamed for causing ecological damage for practising unsustainable methods or activities. Many approaches have ensured an effort to study the environmental loss and the economic effects or social effects independent from each other. The need to study the functioning of agricultural system while keeping farmers and farming together, ecological sustainability, problems and opportunities are therefore important for this research work. Many questions needed to be addressed. For instance; despite the use of high yielding varieties and modern implements, good fertilizers, why is agriculture said to be stagnating? If the stagnation in agriculture is affecting socio- economic network, what are the effects? What role is played by the institutional policies to promote sustainable utilization and

conservation of natural resources? This research work attempts to shed some light on the above mentioned questions and issues. This study will also examine the role of the agricultural institutions of the state, so as to assess the agricultural policies and management of produce. These mechanisms are bound to have considerable effect on the both farmers and farming and might give an answer to certain environmental problems or specific land use patterns. In addition study will also attempt to give new recommendations or guidelines after assessing the research conducted. Future perspectives for the farmers will also be explored.

1.2 Research aims and Objectives

The main objective of the study is to *look into the reason of agricultural stagnation within the framework of environmental and social perspectives*. It will be studied by the help of certain environmental and economic parameters. The research will be done by studying the institutional mechanisms, at the state level, analysing the present resource use and the changes which result from certain agricultural activities of the farmers. Also these causes will be determined by studying the institutional mechanism operating in the agricultural community and the present resources for agricultural use.

The study focuses on these specific subs – objectives:-

- To examine the changing trends in terms of ecology and economy of agriculture in the state in correspondence to the pre and post green revolution period.
- To examine the role of major institutions in regard to the agricultural practices and patterns in the state.
- To suggest ways to counter the present trend in agriculture and hence improve the situation of farmers and farming in the state.

1.3 Research Justification

The look into the reasons which lead to agricultural stagnation are crucial in order to address the problem adequately. This assumes even more significance in view of importance of agriculture to the economy and farmers of the state. The importance of vibrant agriculture has been clearly discussed in Punjab's economic policies and other supporting documents and plans.

The need to study the functioning of agriculture and resource management, with their impact on ecological sustainability and economic opportunities are therefore of paramount interest in both academic and policy circles. The study of farmer's involvement and role in sustainable recourse utilization is also crucial in determining specific land use practices that carry special implications for vital resources such as those in agriculture. Much has been written on the slow agricultural growth and termed it as stagnation but little information was available on the possible reasons in specific socio - economic settings. Recent works on this area are found in annual growth reports, agricultural procurement statistics of the state. This study therefore attempts to present an insight view of the present agriculture practices, handling the causes and effects of stagnation in agriculture through fieldwork carried among the local farmers of the state.

Some attempts are being made by some government institutions to help the farmers to pull them out of this stagnating profession, this study also seeks to examine to what extend farmers are responding to such programmes and what are their views about the efforts. Also to study that if the designed programmes are not working for farmers, then what are the reasons? This study will also try to shed some light on the issue of social aspect, by finding out if the agricultural slowdown has any relation with the social behaviour of the farmers. It is expected that useful information, comments and suggestions from the study will go a long way in shedding some light on Punjab's agricultural problems by focussing on the interactive relation between farmers and their recourses.

The support of all the elements concerned in this study will be crucial to address the research objective adequately. This study hopes to find the linkages between the integrated factors between farmers and farming in the state of Punjab.

1.4 Organisation of the Study

The study is divisible into three parts. The first segment focuses on the concepts, theories and perspectives in social science associated with the study undertaken. It also highlights on the methods adopted to collect and process data. The second part looks at the key changes in agricultural pattern in the state especially on the agricultural prospects in the pre and post green revolution period.

Then it also includes the possible reasons identified for the stagnation. The third and the final section deals with the role of institution related to the field and possible recommendation s from the study.

The final report is organised into eight chapters. The first chapter has presented the general introduction and background to the study, research problem and goals of the study. Research setting including the characteristics of study area forms the second chapter. Literature on the main theoretical prospective, resource management approaches, and other relevant regimes are discussed in chapter three. This chapter ends with a presentation of a conceptual framework within which the study is analysed. The research approach, sample selection process and data collection methods are issues discussed in chapter four. Chapter five discusses the changes in the agricultural scene over a period of time in agriculture. The possible results meeting the goals of the study are presented in chapter six. Chapter deals with the study of major agricultural institution sin the state. Major issues are summed up in chapter eight including recommendations for action and further research.

Chapter Two

The Research Setting

2.0 Introduction:-

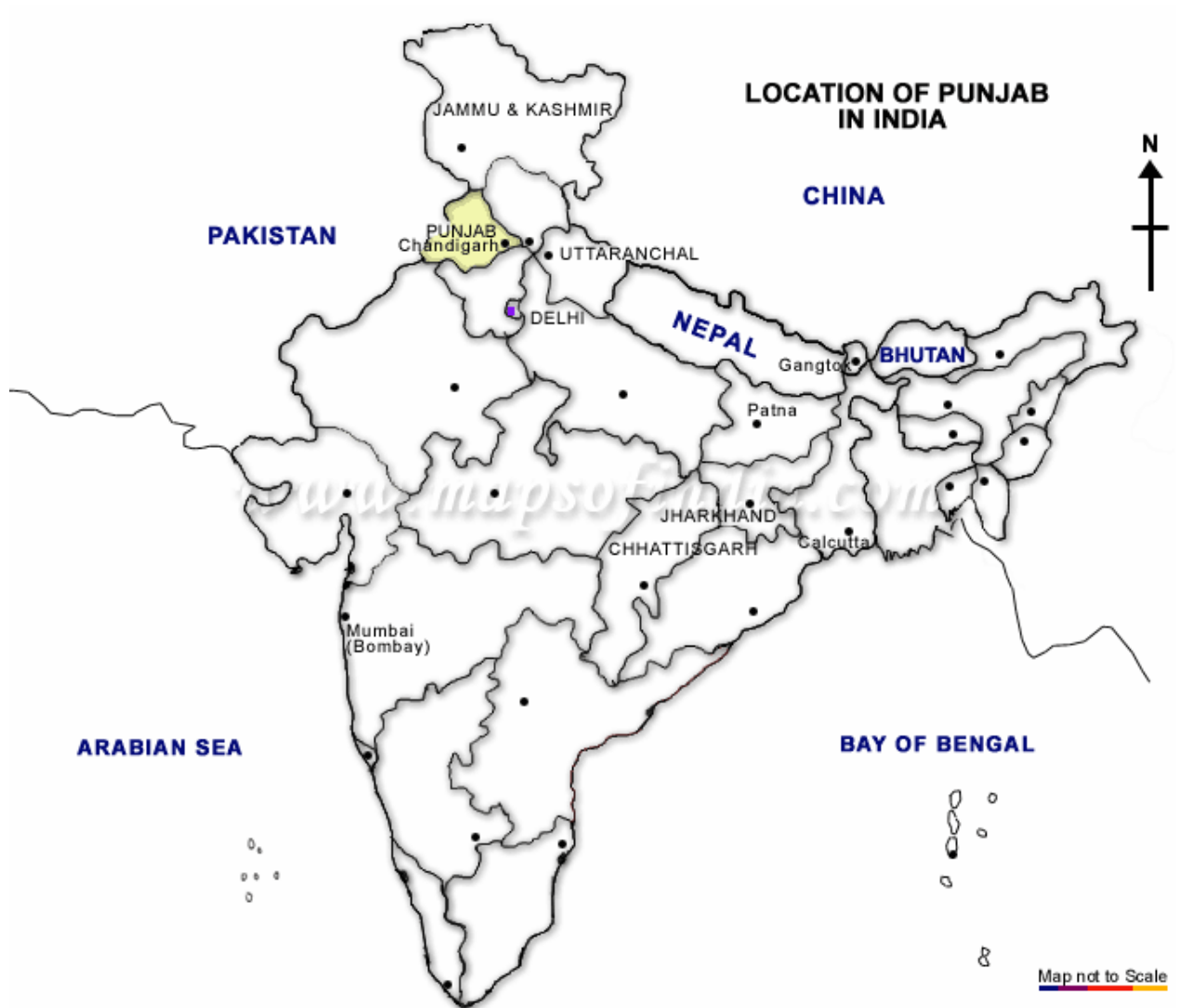
The word Punjab is made up of two Persian words 'Punj' means five and 'Aab' means water. This name was given to this land due to presence of five rivers within its territory. Prior to independence of India in 1947, Punjab extended across both sides of what now is India – Pakistan border with Lahore its capital. But after independence, Punjab was again divided into two parts, one going to Pakistan and the other half staying with India. Chandigarh, the first planned city of India was build and it became Indian Punjab's capital. In 1966 Punjab was again bifurcated into two states, predominantly Punjabi speaking state of Punjab and Hindi speaking state of Haryana (refer to url² on page 110).

However, due to the partition of the state during the independence of India and creation of Pakistan in 1947, presently only three rivers remain in Punjab. Presently, Punjab is one of the smallest states of India, with an area of 50362 sqkm², which constitutes about 1.53 percent of the total geographical area of the country. It is located between 29° and 32'n latitude and 74° and 17' longitude (refer to url³ on page 110). According to Indian census, 2001, this modest – sized state tucked away on the north-western border of the country has a population of 25 million.

The state is divided into 17 districts with its capital in Chandigarh. Physically the state may be divided into two parts; sub shivalik strip and Sutlej - Ghagger plain. Punjab has an uncommon prominence in India. For more than four decades now, it has remained the most prosperous state in the country with lowest rates of poverty (Punjab development report, 2004). Its turbulent history, including redrawing of its borders at the time of independence in 1947, huge grain surpluses produced by its farmers since the green revolution which helped the country gain self sufficiency in food, its location as a frontline state on an often hostile border, it has contributed positively in the development of the country.

Location of Punjab state which lies in the north western part of India as shown in the map below.

Map of Punjab within India



Source: www.mapsofindia.com

As, seen the location of Punjab within India, Punjab is sharing international borders with Pakistan on its west, with Jammu and Kashmir in its north, Himachal Pradesh in its east, Haryana and Rajasthan in its south. The capital of the state 'Chandigarh' is about 300 kilometres north to New Delhi, the capital of India.

Majority of the state's population lives in villages and agriculture is the most important activity of the state. Agricultural land is the state's most important natural endowment. The

Punjab's prosperity has been largely due to the state's development of agriculture. There are some major factors that have led to the Punjab's highly productive agricultural system. One factor is its fertile soil. Punjab is for the most part a large, flat plain of fertile alluvial soil. Other factors include extensive irrigation works, suitable climate, hardworking farmers and above all the advent of green revolution.

Punjab is divided into 17 Administrative Districts with 143 towns and 12413 villages. Further more it has 72 Tehsils (a district is divided into smaller areas called Tehsils) and 140 Development blocks. The major economic activities apart from agriculture are industries which are located in cities but mainly in central city of Ludhiana, southern district of Patiala and the northern district of Amritsar.

Population of the state is rural dominated which accounts for 16.04 million (66.05 %) while urban population accounting for 8.24 million (33.95%). With this population the density is 482 persons per sq km. The overall literacy rate in the state at present is 69.95% which constitutes 75.2 percent male literacy and 63.4 percent is precisely the female literacy rate in the state (India census, 2001).

In terms of connectivity, the state capital, Chandigarh has excellent air services, linking with New Delhi. Amritsar airport is an international airport making an important link between the state and rest of the world. By air, from Delhi one can reach any city in Punjab within two hours. Other well connected airports are situated at Chandigarh, Amritsar & Ludhiana.

Ludhiana district boasts of having an Inland container depot which serves to major industrial requirements. All major towns and district headquarters have excellent rail links for both passenger and goods traffic. Chandigarh, Ludhiana, Amritsar, Ferozepur and Jalandhar are on the main line and have excellent daily train services to other states for both passenger and freight transportation.

A detailed population and area of all the districts of Punjab is given below (Table 1) with three districts highlighted as being the study area for this research work.

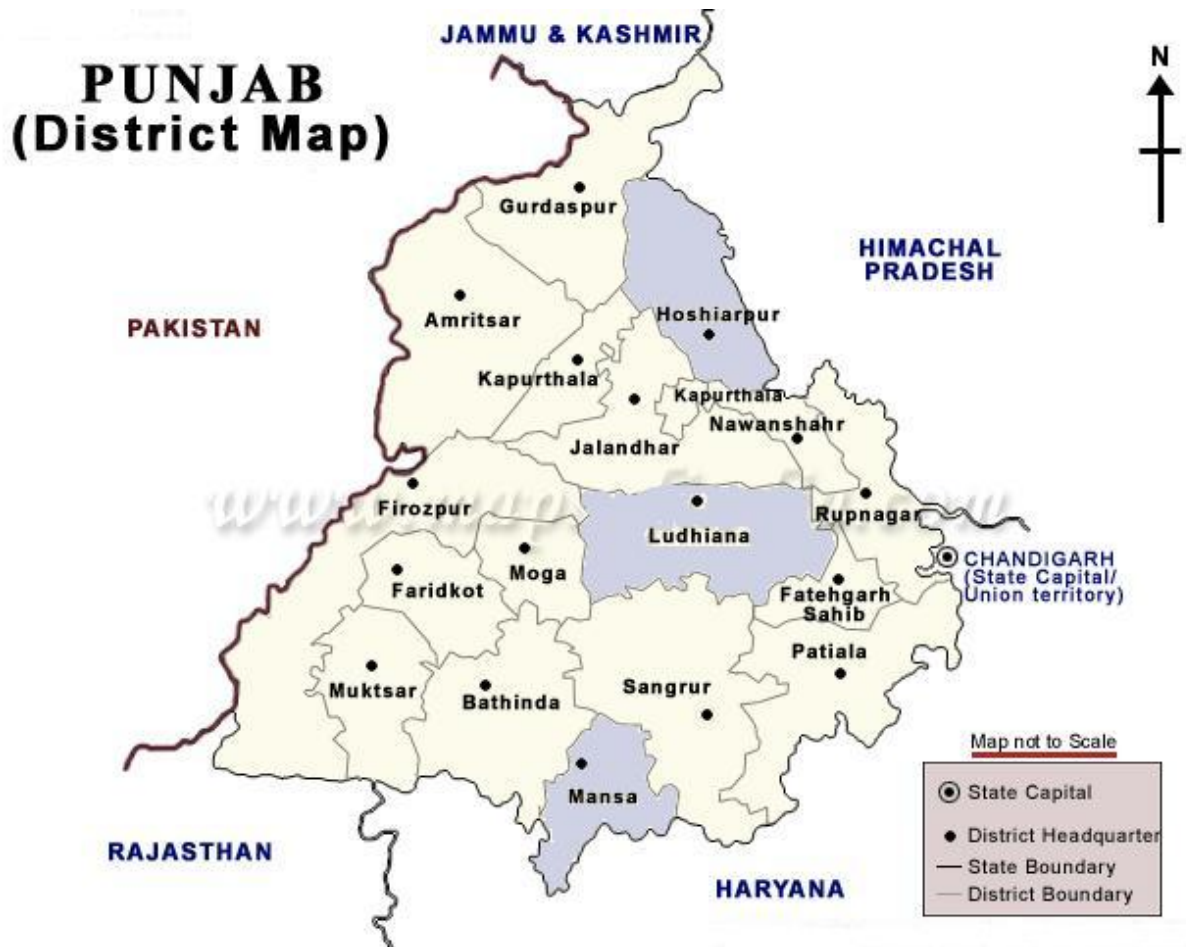
District	Area (km²)	Population (2001)
Amritsar	5088	3074207
Bathinda	3401	1181236
Faridkot	1472	552466
Fatehgarh Sahib	1172	539751
Ferozpur	5853	1744753
Gurdaspur	3570	2096889
Hosiarpur	3310	1478045
Jalandhar	2643	1953508
Kapurthala	1633	752287
Ludhiana	3762	3030352
Mansa	2170	688630
Moga	1672	886313
Muktsar	2608	776702
Nawan shehar	1258	586637
Patiala	3627	1839056
Roopnagar(Ropar)	2117	1110000
Sangrur	5021	1998464

Source: compiled from (census 2001 and www.mypind.com).

2.1 Study Area and its Characteristics:-

Fieldwork was conducted in the three districts of Punjab, namely Ludhiana, Hosiarpur and Mansa.

Hosiarpur district is the easternmost district bordering with the Himalayan state of Himachal Pradesh this district comprises of 4 tehsils. Ludhiana is located in the middle of the state and it is further divided into 10 tehsils, while Mansa is located in the southern part of the state with 3 tehsils. The exact location of the study area (shaded) can be visualized from the district map of Punjab as below.



Source: www.mapsofindia.com

2.1.1 Location and size:-

Punjab, located between the Indus and Ganges River, is largely an alluvial plain irrigated by canals. Punjab's arid southern border edges the Thar or Great Indian Desert. The Shivalik Ranges rise majestically in the North. As mentioned earlier the study area comprising of three districts. One of the districts 'Hoshiarpur' lie in the north eastern part of the state having an area of 3,310 sq km. This district is situated at the base of shivalik hills therefore is a semi hill area at the latitude of 31.32 N and longitude of 75.57 E. The second district to be studied was 'Ludhiana', situated in the heart of the state has an area of 3,744 sq km; the district is one of the biggest districts in the state both area and population wise and is located at 30.55 N and 75.54 E. The third district 'Mansa' is situated in the southern part of the state with an area of 2,174 sq km. This district shares its borders with the neighbouring state of Haryana and is generally considered to be the isolated district of the state partly due to its cornered position (refer to url⁴ on page 110).

2.1.2 Relief and Drainage:-

From the geographical and physiographic point of view, Punjab falls into two regions: the Shivaliks and the Plain. The Shivalik region covers the outer range of the Shivalik Hills which is approximately 6 to 10 kms in width. Their height ranges between 400 and 700 metres above sea level. It consists of conglomerates, clays and silts-all having the character of fluvial deposits of rivers and stream. The low range of the Shivalik Hills separates the Himalayas from the plains. The Shivalik region covers the eastern most areas of Ropar, Hoshiarpur and Gurdaspur districts.

The Punjab plain is a part of the great Indo-Gangetic plain which is a synclinal basin formed by the elevation of the Himalayas. The Punjab plain lies between 180 and 300 meters above sea level. It is higher near the Shivalik Hills but slopes away from them. The tract covering central Punjab ranges between 230 and 270 metres above sea level while western Bhatinda and Ferozepur districts lie below 230 metres above sea level. The land slopes from east to west. The gradient is much more in the east than in the west but generally except for the strip of the shivalik hills along the states eastern border, the entire area is a flat, alluvial plain with elevation ranging between 180 and 300 meters above sea level.

The 'Hoshiarpur' district is situated on the foothills of Himalayas, so it has gently undulating terrain becoming mountainous towards the eastern border. The district of 'Ludhiana' is almost plain in terrain and is very fortunate to have 'Sutluj', which is one of the major rivers passing through the state. 'Mansa' district is characterized by semi sandy soil but more or less the district has plain terrain except for few sand dune areas. As mentioned earlier, the state of Punjab is fortunate to have three rivers namely Ravi, Beas, Sutluj and the seasonal river Ghaggar. River Ravi touches the northern most part of the state partly passing through the districts of Amritsar. Beas River enters Punjab through its western border and joins river Sutluj which passes through the middle of the state. This pattern of rivers divides the state into three cultural zones namely, Majha, Doaba and Malwa. The state has majority of its land under the Ganga plains region which is one of the most fertile lands in the country and has been formed by the slow deposition of alluvial sediments from the rivers over long time.

2.1.3 Vegetation, Climate and Soil

There are three well defined seasons in the Punjab. These are: Hot Season (mid-April to the end of June), Rainy Season (early July to the end of September), and Cold Season (early December to the end of February). The transitional seasons are Post-monsoon (September to end of November), this is the most welcome season and the agricultural year starts with its advent. Monsoon winds reach the region normally in the first weeks of July. The Bay of Bengal branch of the monsoon current is the main source of rainfall. It is transitional period between the rainy and cold seasons. Pre-hot season (March to mid-April), it is a transitional period between the cold and hot seasons. The sub-tropical latitudinal and continental location of Punjab makes the variation of temperature from month to month very high. Though the minimum air temperature rarely drops below 0° C, ground frost is a common phenomenon in mid -winter. The rise in temperature is gradual when the air has high moisture content with the sky remaining overcast; the rise is however steep when the sky is clear and there is little moisture content in the air.

But generally the climate of Punjab is typically subtropical with hot summers (temperatures reaching as high as 47°C) in certain areas and cold winters (lowest temperatures touching up to -2°C). The annual rainfall is around 462 mm in plains and 890 mm in the northern submontane regions characterised by the lower shivaliks. About 70 percent of the annual rainfall is received during monsoon months (June to August) and a part of it is received during winters (January), (PSCST, 1995). During the winter season, weather in Punjab is normally cool and dry. This type of weather is associated with the passage of western disturbances through the region. The importance of winter rainfall in Punjab is immense primarily because of its time and effectiveness. In the area adjoining the Shivalik Hills, winter crops are dependent upon this rainfall. The sub-Shivalik region receives more than 100 mm of rainfall from December to March.

In Punjab the soil characteristics are influenced to a very limited extent by the topography, vegetation and parent rock. The variation in soil profile characteristics are much more pronounced because of the regional climatic differences. Punjab can be divided into three distinct regions on the basis of soil types

1. SOUTH-WESTERN PUNJAB

This region covers the tehsils of Fazilka, Muktsar, Bhatinda, Mansa and parts of Ferozepur which border Haryana and Rajasthan states in the south-west. The soil is predominantly calcareous, developed under hot and arid to semi-arid conditions. The pH value ranges from 7.8 to 8.5 which shows that the soil is normal in reaction. Grey and red desert, calsisol, regosol and alluvial soils are found in this zone. This soil zone with less moisture content is ideal for cotton crop. Mansa which is one of the study districts has been traditionally known for good cotton production.

2. CENTRAL PUNJAB

The soil of this zone has developed under semi-arid condition. The soil is sandy loam to clayey with normal reaction (pH from 7.8 to 8.5). The soil covers the districts of Sangrur, Patiala, Ludhiana, Jalandhar, Kapurthala, and Amritsar, parts of Gurdaspur, Ferozepur and fringes of Kharar tehsil of Ropar district. This clayey soil type has characteristics of holding water and moisture which makes it fit for rice cultivation. Ludhiana district was selected from this soil zone as a representative district.

3. EASTERN PUNJAB

The soil has developed in the sub-humid foothill areas bordering Himachal Pradesh covering eastern parts of Gurdaspur, Hoshiarpur, Ropar and north-eastern fringes of Patiala district. Because of the undulating topography and fair amount of rainfall, normal erosion is quite common. The fertility of the soil is medium to low and the texture is loamy to clayey. District Hoshiarpur was selected from this third region of soil types.

So, in a way, Punjab is very fortunate to have good soils which result into exceptional agricultural capability in terms of production.

2.1.4 Land Utilization

Being primarily an agricultural state, majority of the land is devoted to agriculture. Although the land under agriculture has not changed much since 1970's but there has been some difference in the utilization of the land. It can be seen in the table (2) below which shows the land utilization in Punjab with two time series.

Table (2)

Land utilization in Punjab (000 ha)

Item	1970-71	2001-02
Geographical area	5033	5033
Area under forests	123	281
Unculturable and barren land	208	45
Non-agricultural use	416	409
Culturable land	92	14
Fallow land	139	26
Net area sown	4053	4268
Cropped area	5678	7941
Cropping intensity (%)	140	186

Source: (Singh et al, 1997)

As in the table (2), above shows the land division in the state. It can be noted that the barren land in the state is almost negligible and the fallow land has also reduced drastically. Net sown area is almost stagnated due to the limitation of fixed land available for agriculture. Non agricultural land includes urban areas and the areas which are not used for either agriculture or urban settings. But basically, it is used for expanding cities with the ever increasing population. Due to pressure on land, cropping intensity has also increased significantly during the last three decades. Interestingly area under forests has increased because of various forestry schemes which were launched intensively by the government. It should be noted that the cultivable land, which is not yet utilized is not much left resulting in the state with limited opportunity to increase the area under agriculture horizontally.

2.2 Socio – Economic Activities

It is the rich tradition that has made this part of India a laboratory of the process of economic, social and cultural transformation, through the participation of the people in building their own destiny. Punjabi's are fortunate to have a long cultural history. The typical Punjabi is an extrovert, a sociable fellow who likes to eat well and dress well. Punjabi's are known for their ability to learn quickly and assimilate new cultures without difficulty. Family honour is of great importance to Punjabi's, but generally Punjabi's tends to be liberal minded. It is a matter

of pride for Punjabi's to be "up to date". Their enterprise and capacity to work hard are legendary and their deepest ambition is to "be their own boss".

The social bonds are normally strong between families. The major social activities include marriages and festivals which are celebrated with great fervour. Marriages hold an important place in the family traditions and are generally celebrated on a grand scale. An average Punjabi spends considerable amount of money in organising marriage ceremonies which include catering to large gatherings and often expensive dowries in case of girl marriage. The rich lifestyle is exhibited in all forms in Punjabi culture whether it is functions or festivals.

Punjabi society is marked with some discriminations also particularly: - consistently low and declining sex ratio (the gender ratio is only 874), which is one of the lowest in India (Punjab development report, 2004). The high costs of dowry involved in girl marriages are one of the reasons which lead to sex selective abortions in the state.

When it comes to economic activities, apart from agriculture, industries contribute in providing employment and income. For the industrial development of an area infrastructure plays a significant role. The rapid industrialization depends on the adequate availability facilities like road, Railways, power, water and developed transport and communication network, financing and administrative support from Central/State Govt. etc. Except for some major cities, industries are not very wide spread in the state due to non availability of any kind of raw material in the state.

Particularly the districts of Ludhiana, Patiala, Amritsar and Jalandhar have considerable industries but rest of the state has negligible industrialization. The reason for the above mentioned districts to be industrialized may be accredited due to their well connectivity with other states through national highways. Particularly, the Ludhiana district is the hub of hosiery and called the Manchester of India. A variety of items such as cycle and cycle parts, sewing machines and components, automobiles parts and accessories hosiery and knitwear goods, industrial fasteners, machine tools and components rubber goods, woolen garments, electronic goods etc. are being produced in the small scale sector. The industry in large and Medium sector is producing items as bicycles, hosiery goods, tyres, tubes, electronic goods, steel and alloy steel castings, beer, sugar, flour rice/rice bran oil and cattle feed etc.

Industries in Ludhiana provide ample job opportunities for the surrounding areas of the city. Large number of migrant labour is employed in these kinds of factories within the city. This migrant labour is mostly from the other economically backward states of India. The nature of employment in these factories is permanent except for some like hosiery which is seasonal in nature.

2.3 Summary

In this chapter, general introduction of the Punjab and particularly of study area is presented. I have presented the general, physical and socio – economic characteristics of the wider regional economy and the study area in particular. Out of the three study districts, Ludhiana is the most industrialized whereas Mansa is considered as one of the most backward district in the state. The physical geography of the Hosiarpur is different from the state due to the influence of lower Himalayas. But generally, the state depends upon the agriculture with majority of its population depending on it. With such a massive dependence on agriculture, it assumes great importance for the state's economy and for its development. Besides the description of location and size, relief, drainage, vegetation, climate and soil are also discussed in respect to their relevance to the research work. The next chapter continues with the literature on the major perspectives, theories and approaches in relation to agriculture management in general and its relationship with Punjabi farmers in particular.

Chapter Three

Theoretical framework

3.0 Introduction

A set of connected statements used in explanation can be called a theory. Theories play crucial role in social science for generating ideas. It is virtually impossible to do research without a theory. The nature and status of theories differ among philosophies of social science. With the help of theories we can analyse and synthesize various frameworks, these theoretical frameworks help us to lay the foundation for research and practice. Hence, in doing a study that involves research, it is important to choose appropriate concepts and theories that are capable of fully explaining the reality of the situation.

The theoretical and analytical framework adopted in this study therefore combines an agricultural and resource management approach, which deals with the relationship between resources and farmers. Resource geography has its roots in the human and environmental tradition and is characterised by the focus on human-environment relationships. This chapter discuss as various dominant theoretical perspectives relating to the major factors of the study.

3.1 Perspectives on Agriculture and Environment Management in Punjab

Most environmental issues that have been raised at the turn of the 21st century have been linked to several socio-economic issues and these have facilitated the conceptualization of various thoughts that have permeated discussions held at various levels. The relationship between people and their environment is probably the most important core theme in geography in present times. The work of French human geographers Vidal de la Blache and Lucien Febvre have explained the environment- society relation as one in which the physical environment offers possibilities for human existence and adaptation. They emphasised the role of society in taking advantage of the possibilities presented by its geographical environment. This relationship between humankind and nature thus involves both physical nature and the mental nature of humanity and hence human values. This interaction has had the effect of transforming the relationship of people and their environment through the course of history. Humans have been acting as active agents in realising the possibilities presented by

natural environment and also as potential destroyers of that environment. Modern geographers like Carl O.Sauer have defined humans as active agents, affecting the nature around them.

Different societies or social groups perceive and use the environment in different ways which can be understood by learning about the geographical behaviour of the people as it is this integration between the perception and the practice of the society which leads to different dimensions of the relation between them.

According to Chris, 1990, it has increasingly been accepted that both the environmental and the structural views contain considerable elements of truth but are incomplete in isolation. As a result, attention has focused on the way structural processes interact with the environment. It is of great importance to see whether this statement is applicable in the case of this present study.

To begin with, we have to understand the green revolution period in Punjab. According to Chris Dixon, the term green revolution can be attached with three distinct meanings:-

- 1) A breakthrough in plant breeding that produced high yielding food grains.
- 2) A package of technology, including fertilizer, insecticide, implements, water control and HYV seeds.
- 3) An agricultural development strategy in which the application of technology to third world agriculture is central to the problem of increasing food production.

In case of Punjab it was more to do with the introduction of HYV's which were introduced in India in 1965 and were the results of work by Mexican agricultural experiments which triggered the advent of green revolution.

Resource-society theme has always been concerned about human perception and utilization of environment and resources used for certain human practices. One of the main approaches to environmental damage, the 'classical approach' by (Blaike, 1985; Biot et al, 1994) advocates the extend and solution to the environmental problem is well known but the challenge is to get people to implement it. The above said approach emphasizes on four major elements:

- 1) Identification of an environmental problem, 2) Subsistence-oriented production,
- 3) Mismanagement of the environment by the users and 4) Over population.

To tackle these set of problems, diagnosis associated with the approach includes-

- Identification of problem as serious, indicating that it needs immediate attention.
- Technical measures requiring the co-operation between the communities
- Different plans to be implemented through the combination of encouragement, persuasion and intervention of the state institutions.

The above discussion sets the base for considering the case of Punjab agriculture, which is facing ecological damage including sharp decline in ground water table. In order to understand the present situation better, we need to discuss the background of the situation first. By mid 1960's, green revolution swept the state, this revolution was a combined effort of many factors in case of Punjab. According to (Martin et al.1992) Productivity increases in developing countries are dependant upon a number of factors. Prominent among those factors include 'ecological factors' specially degradation of intensively farmed agricultural land, deterioration of environmental characteristics. These factors play an important role in determining the agricultural productivity in terms of production and incomes.

Another factor is the 'institutional factor' which includes human resource developments, the social organisation of agriculture, and the efficiency of government and participant ant organisations. These organisations play an important role in determining the future trends in agriculture and are responsible for formulation of policies which have direct impact on farmers and farming.

Last but not the least, 'economic factors' also play an important part in increasing agricultural efficiency. These factors include profit incentives to farmers, fixing prices of agricultural produce and marketed outputs. The setting up of minimum support price is an important step towards giving some kind of assurity by the government that the produce of the framers will be bought at a certain fixed price. It discourages the exploitation of farmers by other private procurement agencies.

These were principally the factors on which Punjab's success was based. But as the time went on, the state started witnessing stagnation in the yields of major crops accompanied by severe environmental problems associated with the dominant crops.

Martin argues that, the projections based on the extrapolation of historic trends aim tend to show the longer term impacts of these factors. These factors will definitely tend to shift the characteristics in positive or negative direction when they are allowed to continue on longer terms. For instance, he says that if economic incentives are increased for the agriculture then it will result in result in better economic support for farmers but in contrary to this statement, (Mellor et al, 1985) argues that if agricultural produce is cheap then it will generate more income within people rather than giving more incentives to farmers and making the produce expensive in the market. He says that lower food prices to consumers generate more economic development than higher agricultural prices to farmers. These lines of argument are incompatible with each other. It has to be seen that in case of Punjab agriculture, what kind of impact the incentives has on farmers' income. This will be seen after the results of the present study that if farmers are using those incentives to generate more income or in which channel are they investing there income.

There are certain sources and issues which are responsible for sustained production growth, major among are -

The economic climate for growth- it is important to situate the projected trends in a discussion of the underlying sources of growth and of the constraints. Within the agricultural sector, governments in developing countries like India face important competing uses for scarce budget recourses. The agricultural budget finds its utilization in financial costs of producer price supports and subsidies for inputs specially fertilizers and cheap credit facilities. Because at the same time the funds have to be diverted for many other purposes like new technology innovation, infrastructure like roads etc. Similar requirements are there for social investment.

Area and yields- agricultural area is an important character for increasing growth in production. There is potentially no scope of expansion in agricultural area in the state of Punjab, even in contrast; the agricultural land can decline in coming years due to rapid urbanization and increasing population. Yields are based on the research activity which is normally carried out in the agricultural institutions. So for this purpose the role of institutions become very important for the functioning of agricultural system.

But despite meeting all the above factors, there are some ecological threats to continued production growth. According to Martin, there is increasing concern about the sustainability of agricultural production. This comes partly from environmental degradation of currently relatively high yielding land. There can also be concerns about diseases, pests and genetic adaptability.

Punjab is the area most closely identified with the gains of the green revolution. Within Punjab itself, Ludhiana district was seen as the spearhead of an Indian agricultural revolution¹ and also a model for third world agricultural development in general.¹

My aim is to study the agriculture stagnation in Punjab in a broader prospect. Farming can not be studied without integrating it with the farmers. This study emphasis and analysis the role of farmers, farming, institutions together in order to study the causes and effects of stagnation in agriculture.

According to (Peggy F. Barlett, 1980), there is increasing complexity of development problems and proposed solutions. Agricultural development involves change in two dimensions: the kinds of crops grown and the way they are grown. In both dimension, agronomic behaviours ramify into the entire social and political organization of rural life. Planned agricultural development projects also involve the introduction of new crops as farmers are urged to try diversification in agriculture. Whereas many communities grow same crops, they had grown over centuries, other change their production decisions in response to national price, market politics and to changing infrastructure. Turning to second major dimension of agricultural development, decisions on agricultural techniques give rise to some of the same issues. In many areas of the world, development projects have not introduced new crops but have instead tried to increase the productivity of traditional crops. The most common single change is the introduction of chemical fertilizers, insecticides, machinery and irrigation. It is important to understand the farmer's perception and behaviour towards agriculture.

(C. Gladwin, 1980) discusses a theory of 'real life decisions' in which she explores that decisions taken by farmers are often based on attentive and preattentive modes. This

¹ See appendix I

distinction explains some aspects of current decisions and also suggests how past decisions are integrated into behaviours and choice patterns. She says that the cropping decision to be taken by the farmer actually depends upon the many factors. These factors range from demand of the crop to the soils, water requirements, knowledge, time, labour and credit, often arranged in a format of decision tree. She also talks about the diversification decision for the farmer where a farmer tends to diversify to other crops if he finds it more profitable and less risky. It much depends upon the value of the crop to which the farmer wants to diversify. If the value and the risk of the new crop is more, then the farmer can still tend to go for it but if the value of both crops more or less are equal, there is no reason for the farmer to take the risk of the riskier crop. This would be the case between rice and sugarcane, when the farmer thinks they have about equal returns.

3.2 Structuration Theory

The British sociologist Anthony Giddens is credited with structuration theory which explains the integration between agency and structure. For Giddens, human agency and social structure are not two separate concepts or constructs, but are two ways of considering social action. There is a duality of structures so that on one side it is composed of situated actors who undertake social action and interaction, and their knowledge activities in various situations. At the same time, it is also the rules, resources, and interaction and social relationships that are produced and reproduced in social interaction. Giddens defines structuration as ‘the structuring of social relations across time and space, in virtue of duality of structure’ (Giddens, 1990).

Structuration attempts to understand a particular environment and how people tend to use their resources to enhance their lives. Giddens makes this point by saying that the basic domain of study of the social sciences, according to the theory of structuration, is neither the experience of individual actor, nor the existence of any form of social totality, but social practises ordered across space and time. Giddens distinguishes the systems and structures; according to him systems are ‘patterns of relations in grouping of all kinds, from small, intimate groups, to social networks, to large organizations. That is, it is the patterns of enacted conduct, the repeated forms of social action and interaction, or the ‘enduring cycles of reproduced relations’ that form social systems.

For Giddens, structure is somewhat more specific and detailed and refers to practices, which are structured along certain lines. These are:

- i) Procedural rules about how the practice is performed for e.g. in the case of Punjab, government procures produce from farmers. So the farmers are dependent on government system and naturally they will grow only that crops which will be bought by government, in this case rice and wheat.
- ii) Moral rules about appropriate forms of enactments of social action, laws, what is permissible and what is not, i.e. appropriate ways of carrying out social action and interaction i.e. farmers action of early rice transplantation rather than waiting for the prescribed time which damages ecological balance by using more underground water rather than rain water.
- iii) Material resources about allocation of resources among activities and members of society, commodities i.e. loans from co-operative banks, grameen banks, which give money on very less interest.
- iv) Resources of authority on formal organizations, how time and space are organized. The efforts, which are done by organizations like Punjab agricultural university, kisan unions, play an important role in creating awareness.

Structures such as market exchange, class structures, political organizations and processes and educational institutions all have these aspects to them. It is enacted human conduct in the form of structured practices that maintains and reproduces these structures. But if these enacted forms of conduct change, either because individuals make conscious decisions to change, or through less conscious forms of adjustment, adaptation, and practice, then this can result in structural change as well. Social movements, collective action, or parallel changes by many individuals could have this result.

Giddens suggests, human agency and social structure are in a relationship with each other, and it is the repetition of the acts of individual agents, which reproduces the structure. This means that there are social structure-traditions, institutions, moral codes and established ways of doing things: but it also means that these can be changed when people start to ignore them, replace them, or reproduce them differently.

So people's everyday actions reinforce and reproduce a set of expectations—and it is this set of other people's expectations, which make up the social forces and social structures. As Giddens puts it 'society only has form, and that form only has effects on people, so far as structure is produced and reproduced in what people do' (Giddens and Pierson, 1998). There are some specific practices which are adopted by the farmers but it has to be seen that if farmers themselves are aware of the consequences of their policies. This type of monitoring by the farmers themselves is called reflective monitoring by Giddens. It is this reflective ability that permits individuals to account for, explain and rationalize their actions. Giddens had identified this kind of motivation as the result of conscious or unconscious efforts, in the case of Punjab agricultural practices; it will be interesting to know that these practices are conscious or unconscious. These practices include burning of paddy straw and the decline in ground water due to certain agricultural practices adopted by the farmers. He talks about agency influences the structure and also about the timing of influence which could result changes the type of influence (Giddens, 1979).

In the case of Punjab, the government is pushing for all-out industrial growth, and this is true in the agricultural sector as much as any other. The emphasis is on new agribusiness enterprises such as sugar production. But these are just as intensive as Green Revolution agriculture. Experts from Punjab Agricultural University have been long been saying that building more sugar mills in Punjab is a bad idea, considering that the state is faced with severe groundwater problems. Nor is its soil suitable for growing sugar cane. Such enterprises are more political than agricultural, and they are gravely detrimental. So, we can see that by adopting these steps state government is creating structures for the people to fit in but it is to be decided by people if they want to adjust in the structure or devise an alternative system.

Human ecology focuses on human adjustments to the physical environment. The original concept presented by Harlan Barrows in 1923 referred it to as 'the science of human ecology', although (Bryant and Bailey, 1997) defined this concept as the integrated physical and social scientific understanding of human-environment interaction. They give importance to the interaction between man and environment through use of political and socio-cultural structures. Human ecology perceives resource managers to integrate the environment with economic and social understanding in the process of policy making as well as evaluation of systems (Peet and Thrift, 1989). Local practices reflect people's perception and adjustment of

the environment, to which the knowledge and customs have direct influence. It is therefore important to know the strategies of the local people relating to human use of environmental resources.

3.3 Sustainable Development

The term was first used in 1980 in the world conservation strategy. It is development, which achieves ecological sustainability while striving to meet society's other needs, relating to the topic this can be used regarding efficient use of natural resources during agricultural practices. According to Repetto, (1986), sustainable development is a development strategy that manages all assets, natural resources and human resources, as well as financial and physical assets, for increasing long term wealth and well being. The goal of achieving a sustainable planet, one that will accommodate the basic needs of its present inhabitants while preserving the resources that will enable future generations to flourish, has gained increasing acceptance. According to 'our common future' (Brundtland commission, 1987, refer to url⁵ on page 110), sustainable development is that development which meets the needs of the present without compromising the ability of the future generations to meet their own demands. The word "sustain," from the Latin *sustinere* (*sus-*, from below and *tenere*, to hold), to keep in existence or maintain, implies long-term support or permanence. As it pertains to agriculture, sustainable describes farming systems that are capable of maintaining their productivity and usefulness to society indefinitely. Such systems must be resource conserving, socially supportive, commercially competitive, and environmentally sound. When we talk about the concept of sustainable agriculture, we can conclude that it should cover and satisfy human food requirements, enhance environmental quality and the natural resource base upon which the agricultural economy depends, make the most efficient use of non-renewable resources and on-farm resources. It should also sustain the economic viability of farm operations and most importantly enhance the quality of life for farmers and society as a whole

The notion of sustainability has roots in utilitarian resource management; the concept of sustained yield such as ground water- the level of extraction that could be maintained without lessening future levels. Much of the environmental degradation is associated with the green revolution technology adopted to increase crop output (Bina agarwal, 1981). Although dramatically successful in the later objective in the short run, it has had high environmental costs in the long run, such as falling water tables due to tubewells, water logging, declining

soil fertility with excessive chemical fertilizer use etc. Moreover, the long term sustainability of the output increases achieved so far itself appears doubtful.

Present day agriculture has many characteristics: rapid technological innovation; large capital investments in order to apply production and management technology; large-scale farms; single crops/row crops grown continuously over many seasons; uniform high-yield hybrid crops; extensive use of pesticides, fertilizers, and external energy inputs; high labour efficiency; and dependency on agribusiness. When we talk about sustainable agriculture, we can have different views by different people involved in the field. The agricultural scientists look at the term as a way of consolidating food production and ensuring food sufficiency for the masses. Their main aim is how to make agriculture production more reliable in terms of quantity and quality. When it comes to environmentalists, they refer this term as an important way to more responsible attitude towards environment. They are concerned with the ways and techniques that are adapted in farming practices. They analyse the effects of particular crops and cropping pattern on the environment. Conservation of natural resources within the field of agriculture is their main objective. Similarly for the economists the concept of sustainable development means the appropriate use of our natural resources which are often scarce in such a way that they benefit our present generation but not at the cost of our future generation. It emphasises on economic use of the resources in order to gain sustainable development in the field of agriculture. Whereas the sociologists see sustainable agriculture as the reflection of social values and path constant with traditional values, cultures and institutions. They view traditional values and practices as perfect methods for sustainable agriculture. They often give importance to local and indigenous knowledge and the methods evolved by local people. But even though every group has different views about this term but at least they all agree that there is definitely more importance attached to the sustainability of agriculture in present times.

The agro ecology is defined as the application of ecological concepts and principles to the design and management of sustainable agro ecosystems. An ecosystem framework is shown to be essential for determining (1) if a particular agricultural practice, input, or management decision contributes to or detracts from sustainability, and (2) the ecological basis for the functioning of the chosen management strategy over the long-term. Such an orientation is essential for developing alternatives that reduce purchased external inputs, lessen the impacts of such inputs when they are used, and establish a basis for designing systems that help

farmers sustain their farms and their farming communities. We can first outline the reasons why an agro ecological approach to agriculture is needed, as well as defining and describing both agro ecology and sustainable agriculture. With a primary focus on crop plants, the second focus would be on the interaction between the individual crop organism and the environment, building an autecological framework for understanding how factors of the environment function and can be managed. Thirdly we should examine the system level interactions, stressing the need for understanding these ecosystems that are of value in sustainable agriculture. Then we can propose a framework for setting the parameters for sustainability, which outlines the indicators that can best inform us if we are moving in the necessary directions, and explains how to broaden the agenda of sustainability to include the whole food system. Humans and human society must be integrated with the ecological knowledge of agro ecosystem sustainability, bringing us back to the understanding that agro ecosystems are, after all, the co evolution between a culture and its environment. In this balance lies true sustainability.

Since the time of green revolution, we have been experiencing some drastic changes in the farming techniques as well as in the use of inputs. Post green revolution period has seen less traditional values being actually applied in the fields, these changes range from the use of less green manure and higher use of synthetic fertilizers, the increasing prevalence of rice-wheat combination instead of traditional mixed pattern of cropping. Some of these changes among others have led to a distinct change in the pre and post green revolution periods especially in regard to the environmental changes in agriculture. It has been established beyond doubt that for the success of agriculture there should be a sustainable use of natural and man made resources using human skills and labour. We can say that in order to sustain our resources, we should try to establish a particular agriculture production system involving the local community and farmers which optimumly utilizes both the internal and external resources in agriculture.

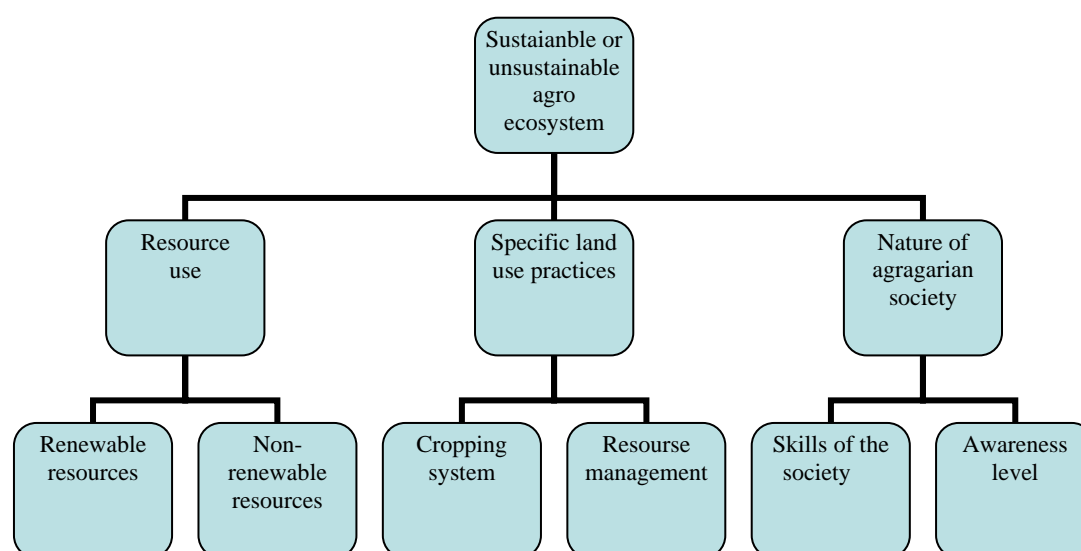
The internal resources are the resources which are inherently renewable and thus have the potential to be used on the sustained basis like rainfall, soil nutrients, biological pest control and green manure, biological fixed nutrition, family labour. Whereas the external resources are classified as the resources which are obtained from outside the community. These mostly include non-renewable resources, like water from deep wells, artificial fertilizers and insecticides, hybrid seeds and hired labour. The use of these internal and external resources

plays an important role in determining the sustainability of the agriculture system and also they have the ability to affect the socio economic structure of the society.

Sustainability refers to whether a system is meant for long term use for present and future generation, to maintain some activity in the face of stress and to maintain the ability to produce. The sustainable system may have a shock, which might come in form of sudden increase in the inputs particularly external resources. These shocks particularly external may lead to collapse of the system altogether.

The major resource inputs in agriculture are labour, land and capital, which are used for investment in fertilizers, diesel, pesticides and agricultural machinery. Examples of agriculture technology that has high potential sustainability are crop rotation, green manuring, and zero tillage, integrated pest management.

If the agro ecosystem is defined so as to include both ecological and socio-economic components, then we can envisage a hierarchy of such a system on the pattern of the hierarchy of agro ecosystems devised by Gordon R. Conway, below is a figure (1) which depicts the systematic chain of steps leading to a particular situation in a particular agriculture system.



Source: Authors own construct

Logical framework approach (LFA) can be applied to explain the structure where we find out the causes of a particular situation and their effects in the above figure. In order to understand the conditions of Punjab agriculture, we consider three main pillars leading to the present situation. These are -

Firstly, we consider the use of resources. These can be of two types as discussed earlier- internal or external. Both of these variants can have effect on the long term use of resources. The major resources which are expected to play the most crucial part in this study include ground water utilization, labour use pattern besides other biotic and abiotic factors. It has to be seen in the further parts of this study that how significant role these resources play in the present agricultural situation of Punjab.

Second characteristic to be considered is the specific land use practices. These include certain type of agricultural practices which are followed by farmers in the area. These can include the cropping pattern, resource management techniques. These variants also affect the agricultural system as they directly influence the ecology of the area.

Thirdly, the skills of the farmers in this case are very important. Their awareness level regarding environmental problems and their skills affect their approach towards the whole profession. Their understanding of the problem and the response can determine the outcome trends in agriculture.

It remains to be seen that how does this model fit into the findings of this study, but definitely it shows the link between the farmers and resources which can lead to a stable or vulnerable agro-ecosystem.

I have used sustainable development concept as it is becoming increasingly clear that a more sustainable agriculture can bring economic, environmental and social benefits, yet despite the emerging evidence most farmers are still locked into modernist approaches to agriculture, which are dependent on high levels of external inputs. I am looking at the scale of the challenge facing agriculture today, and detail the concepts and characteristics of alternative, sustainable agricultural practices, specially when there is also growing evidence that green revolution-style farming is not ecologically sustainable (Shiva, 1991). This concept is ideally suited to my study because Punjab presently is facing agricultural stagnation and this study is an attempt to find out the link between the farmers and the farming of the state for possible answers to the problem.

So according to two core requirements of sustainable development, the diversity of system and the basis of its productivity must be maintained, secondly the society must organize itself so that this is easy to achieve and that the society must have the capability and ability to solve and preferably prevent its major problems in a timely fashion e.g. framers should be educated about the environment problems resulting due to faulty practices and discourage them for early transplantation of rice to minimize ill effects on ecology.

3.4 Political Ecology

The most cited definition of political ecology was articulated by (Blaikie and Brookfield, 1987), to encompass the constantly shifting dialectic between society and land-based resources. The context of political ecology thus emphasises that human–environment relations at local, regional and global scales can be only understood by analysing the relationships of patterns of resource use to political economic forces (Grossman, 1977). This however, implies that political ecology gives central concern to human agency in the transformation of the complex interacting web that characterises the environment (Turshen, 1984).

(Bassett, 1988), argues that the political ecology approach includes the importance of historical analysis in understanding local dynamics, the effects of state policies, activities on the local scale and the effects of local changes in human-environment relations on the structures of social relations. The effects of state policy and action are inherent in political ecology.

It is very important to understand the impact of politics on the economic scene, because the economic setback is often the result of process which constitutes power and recourses. (Chris, 1990) explains this relationship by giving an example about how situations are effected by changes at different levels. For example, if the demand for certain type of crop is reduced, then the government will not increase the minimum support price, which will lead to farmers getting less money as compared to inputs they have used. The smallest farmers will be the hardest hit as they don't posses sufficient reserve money. Further more, because many households need cash urgently to settle debts, purchase essential supplies, or meet unexpected costs, so they take loans and eventually fall in the viscous circle of debt. The poorest

households will be most vulnerable and will lose most in this process. Apart from the relation between polity and economy, there is a strong relation between polity and environment.

Through the study of political ecology, we can understand that the environmental issues are also social issues (Blaikie, 1985). Reasons for this are because any environmental changes will have an effect on the people of the area; secondly these environmental issues need the political expression to highlight them. Blaikie and Brookfield, 1987 attest to the fact that resource problems are approached by examining the social order in dynamic relationship with environment. Political ecology highlights issues of power and the obstacles they present to the achievement of the objectives of sustainable development. Specifically, it examines social and political inequities and their impacts on the environment and the people who depend on it for their livelihoods. The discipline of political ecology seeks to link the two theoretical concepts of political economy and ecological analysis and develops some insights that challenge those involved in reducing the impact of the revolution and making agriculture both sustainable and adequate for a growing human population.

According to Tim Hayward, (1998) explains how human interests bear on ecological values, focussing in particular on how rational self interest and enlightened self interest can be harnessed towards environmental end. The first consideration is that while many environmental problems are attributed to the prevalence of narrow, essentially private and economic interest.

Franz Hartmann, (1998) has explained two views about political ecology. One being the non-specialist view which advocates changes in government policies to create an environmentally sustainable society. The other view is called the popular view defines ecological politics as a complex subject. It advocates better understanding between nature and society. It refers to finding the causes of environmental problems rather than simply changing government policies. Hartmann also advocates the socio- ecological theory of reality. According to this theory he doesn't view nature and society as two different forces but considers that there is a reality which is the product of social and ecological forces and the physical aspect of this reality is the built environment. In this theory of reality, ecological forces include soil, climate etc whereas social forces include habits, customs, institutions etc. according to him

social forces are a distinct subset of ecological forces since humans have the ability to form social relations that affect their behaviour and ecological relations.

World commission on environment and development, 1987 revealed that sustainable development concept should include- a political system that insures people participation, a social system that provides for solutions, production system that preserves the ecological base of for development and an administrative system that is flexible and has the capacity for self correction.

Political ecology includes the effects of state policies, activities on the local scale and the effects of local changes in human- environment relations on the structures of social relations. Political ecology pursues the importance of initiating interactive learning approach in which there is a conscious decision to put people priorities first. To maximize the gains for the poor and to highlight the importance of self-help are considered as ingredients of success in political ecology approach. Sustainable agricultural development cannot be pursued in isolation. Its success depends on its place within an infrastructural development, which complements and reinforces sustainable policies and programmes of the state. The most important aspect of this approach is the application of political will in the desired and positive direction. Proper economic analysis of policy options, especially of their impact on small and marginal farmers is crucial while formulating long term goals and strategies. Economic evaluation of environmental impact should also be considered. Political ecological perspective intends to integrate the political, economic and ecological dimensions of agricultural management.

Political ecology involves an evaluation of the socio-political role of different actors in human environmental interactions, particularly in the third world, where environmental problems attract multi-disiplinary solutions. The linkages between institutions, resources, individuals and societies, which form the core of political ecology, have generated various approaches to perception and application of this concept.

Based on the (Blaikie, 1998) development of a 'chain of explanation' for a specific environmental concern, I have tried to portray the current problem with the help of some links between the certain outcomes and the role of the state.

Historically, Punjab was at the forefront of the Green Revolution in the late 1960s and early 1970s, in which farm machinery, pesticides and fertilisers, irrigation and the replacement of traditional crops with high-yielding varieties dramatically increased productivity. But the land is increasingly unable to support this burden of intensive agriculture. Crop yields--and water resources--are showing signs of decrease and some parts of the state are even close to becoming barren. Many farmers are heavily in debt trap due to stagnating agriculture.

The economic benefits are lapped up by a few, while the long-term fallout is affecting thousands of poor farmers. Indeed, it seems that the farmers themselves are bearing the costs of the Green Revolution. At this stage the role of government needs to be reviewed and necessary policy changes and plans to be put in place. To make these changes work the state needs the true ability to implement new programmes with strong political will and the desire to change the things for better.

In case of Punjab, we have the role of the state which is responsible for government policies, which should be formulated for the benefit of small and marginal farmers, who would change their farming practices and current recourse basis to meet the positive change in ecology only if these policies have appropriate economic incentives. Second key role is played by the abilities of the administration, which are evaluated by the degree of involvement in their design and implementation of the projects. Farmers' response in sustaining the programmes and projects will be determined by their involvement, which is again linked to the administrative capacities of the state. Thirdly, action plans would access the state's power to influence a particular structure. These plans and programmes for sustainable development will only be properly implemented if the appropriate institutional framework is established. These action plans should include an alternative path for the farmers in order to make them shift swiftly to desired stage.

Clubbed with the role of the state are the land users, resources, skills and nature of agrarian society. This includes the knowledge among the farming community, their awareness level and their access to resources. This also includes the level of agricultural skills and techniques

with which they are customized. This aspect can easily be altered with the input of knowledge in terms of institutional help and policy guidance.

These two links lead us to the stage of specific land use practices, which in case of Punjab has lead to two-crop dominance and high crop intensity. The failure of the state and the ignorance of the farmers have led to these negative land use practices which now lead us to physical changes in land system which is the most crucial stage in relation to ecology. Due to specific land use practices there is decline in ground water to alarming levels and deteriorating soil health. It will be seen in the study ahead that what kind of consequences these agricultural practices have on the farmers of the state.

According to (Biggs et al, 1991), the political science and public administration approaches to understanding research institutions go beyond identifying the specific interest groups, such studies take into account the internal dynamics of beaurocratic institutions and the way in which they interact with other institutions. Also, policies to improve the institutional performance of public sector research systems must grapple with the specifics of a system, particularly with resource allocations and the short- run efficiency of system components. That is why political science models do have a major potential for helping policymakers in agricultural research.

3.5 Summary

The approaches which deal with the relationship between human and environment form the main theoretical framework of this study. Various perspectives of the human –environment have been captured. The issues which are related to the problem of the study have been highlighted in this chapter.

The main perspectives run from showing resource management and the role of political institutions. Results and discussions which follow, it is hoped, will throw light on the relationship between farmers and their environment and its effects. In the next chapter, I discuss the methodology adopted for collecting, analysing and presenting data for the study.

Chapter Four

Research Approach and Methodology

4.0 Introduction

The theoretical framework of this study combines environmental as well as societal aspects in geography. It deals with the relationship between farmers, ecology and resources. It also takes into account the role of institutions with regard to the above mentioned relations. Many approaches have advocated the combination of environmental and social science perspectives in studying the complex issues related to environment society and resource management. (Blaikie and Brookfield, 1987; Blaikie, 1995), the issues related to environmental degradation are not only technical, but also socio – economic. The whole relationship between actors involved is complex and requires wider approach to deal with. I took into account these considerations and adopted appropriate approaches, which allowed some level of flexibility in the research design.

This research work aims to study the reasons of agricultural stagnation and the possible relationship between the cause and effects of this stagnation. This chapter concentrates on the criteria adopted for the collection both primary and secondary and processing of data for this research. It also highlights research design, limitations and weakness of the study conducted. This chapter also evaluates the validity and reliability of the collected data.

Research methodology is a coherent set of rules and procedures, which can be used to investigate a phenomenon or situation (Kitchin and Tate, 2000). Social science seeks to generate knowledge about the world by using mainly two methods viz; quantitative and qualitative. In geography, criticism of the quantitative revolution in geography and the subsequent emergence of the cultural turn have resulted into search for alternative ways of understanding the world. Attempts have been made to make distinction between the two. Philo et al, (1998) describes quantitative geographers as those who count, map and model things, whereas qualitative geographers converse, engage and empathise with the people world. In my view, the researcher has to make a choice, predominantly on the basis of research questions, to select approaches and methods most likely to provide insight and

explanation into matters of concern. The selection of methods or sampling also depends upon time available for research, resources available in terms of manpower and cost.

I mainly used qualitative as well as quantitative techniques for this research study. While qualitative methods were used for getting farmers perceptions and official responses, quantitative methods were used for assessing the economic situation of the farmers. Quantitative technique was also used to show special cases for environmental degradation like ground water decline, soil fertility, etc.

As qualitative data is subjective, rich, and in-depth information normally presented in the subjective form. This approach is holistic, as the result we get more accurate reflection of complex reality and a better understanding of the processes, but as a weakness it is difficult to focus and analyse findings. While doing in-depth face to face fieldwork, we can obtain better rapport with respondents but at the same time, this requires skilled investigators.

4.1 Research Rationale, Approach and Strategy

The reason to choose the present study topic lies within my curiosity to find the answers to some of the developments in my home state of Punjab. As being a Punjabi, I felt concerned about the condition of farmers in the state which were often in the headlines regarding depression and suicides. So it was my personal desire and realization of the existing needs that I thought it was certainly a necessity for better in my state. Any contribution on the positive note through my proposed study towards the people of my state will be the ultimate reward for conducting this study.

Both qualitative and quantitative data sources were employed during the survey. The starting point of this work has been to study the relation between farmers and the scenario of agriculture in the state. Three districts were selected for the study, where research was carried. As the result, data material is based on the inputs from these three districts, covering a variety of techniques. The aim was to collect the real time information from the farmers both relating to their socio- economic conditions and their agricultural sector. Quantitative methodology has been used mainly for this study, particularly, the structured techniques of data collection like the use of questionnaires. Qualitative methods used include interviews, group and focus group discussions. Direct observation was also taken into account while visiting study area. These are the techniques which give broad contact between the researcher and the researched.

The multi-method approach has an advantage of being complementary and reinforcing. Information on quantitative data was collected by the help of structured questionnaires, providing useful information about households, agricultural details, both agricultural and social variables. The qualitative data was enhanced through conversation, interviews, and focus group discussions as well as direct observation also helped to monitor social linkages and cultural rules. Farmers opinions, attitudes, perceptions and responses to agricultural concerns, institutions are other relevant information generated through such means.

In order to reap the advantages of the techniques, both methods of qualitative and quantitative data collection methods have been used. The aims of qualitative analysis may be described as getting a total understanding of specific relations, going in dept, and developing hypotheses and theories, while quantitative analysis is aimed at achieving a representative overview of general relations, testing hypotheses and theories. For quantitative studies, data analysis and interpretation has to be carried out after the whole process is finished whereas, in qualitative analysis, it is possible to carry out data analysis and interpretation almost parallel to its collection. Also in qualitative study, we can easily mould the data as there are no standardised analysis techniques like in quantitative which include computation by stastical techniques and tables etc. where of course at one end, qualitative technique is more flexible but at the same time material may become over complex.

While it all depends upon the researcher as many of the techniques can be used in either way of data collection. Qualitative interpretations can also be quantified and very often a combination method (method triangulation) of many methods is useful. Although these two methods are participation oriented; there are some differences that determine the choice of either qualitative or quantitative methods in social science research.

4.2 Choice of Study Area and Sample Respondents

The fieldwork for this research was conducted in the three districts of the state (Refer to map on page 14). As I wanted to get an overall picture of the Punjab state regarding the different factors under study. As mentioned in the introduction section Punjab state is divided in to 17 different districts. These districts are further divided into Tehsils and Sub-Tehsils for the making the good governess and accountability possible. As I was facing the limitation of the

time allotted for fieldwork, I choose 3 different districts in a way representing the whole Punjab state. Among these were 'Hoisarpur' district representing the semi hill area of the state with good quality underground water and having higher percentage of literate population in the state. The second district was my home district 'Ludhiana' which represents the most industrialized area of Punjab with an average literacy rate. The third district was 'Mansa', which represents one of the most backward areas in respect of education and exposure of the people. In this district, ground water here is brackish or not very suitable for agriculture. Selection of these three districts was influenced by many factors. Primarily, I wanted to cover all the characteristics of the state in terms of geography, economy and social as well. So, I tried to get at least one district under this study having different characteristics both geographical and cultural within the state. Of course, time and resource constraints were taken into consideration while deciding for the selection.

Selection of study villages was also based on the criteria to get wider representation from different parts even within the selected districts. Firstly two tehsils were selected from each district while making sure that they were from two different parts of the same district. Then from each of those two tehsils two villages were selected on the same selection pattern. That is how four villages were selected from each district.

Three main factors were considered while the selection of these villages:

- Firstly those villages were not considered which were too close to the city, so as to avoid any semi urban characteristics.
- It was made sure that the selected villages were purely agricultural, where majority of the population is involved in agriculture and not having any substantial industrial plant.
- The selected villages should not be under any special government improvement schemes or the particular village was not considered if it was adopted as a model village.

Sample respondents for the study were farmers across these three districts. Agriculture as an occupation was considered as a criteria for choosing the respondents. The preliminary survey in the area helped to identify key informants like the village heads, agricultural extension officers or any well informed person from that area. Based on the information provided by these informants, relative respondents were contacted. This included visiting farmer's houses or locating them at the common place in the village. Participants for the interviews or focus

group discussions were also selected randomly or/and purposively. Farmers were comprised of landowners' farmers as well as tenant farmers.

4.2.1 Sampling Techniques

As mentioned above, three districts were chosen for the fieldwork to be carried out. Among these districts; I further choose two tehsils in every district and then two villages for every tehsils, resulting in my data collection which comes from 4 villages for every district. I used ten questionnaires for every village to investigate the experiences, reactions and assessments of the involved group. Altogether, I collected 120 questionnaires across 3 districts of the State. Sampling is of great importance because it narrows down the large number of potential respondents to a smaller fraction. I used simple random sampling technique for data collection. I didn't use snow ball sampling technique because I think it could have lead to biased data collection because a rich farmer can refer me to another farmer in his category and vice versa. The other reason was the non availability of economic and housing statistics to support other empirical techniques and of course time was a big factor which prevented a detailed and extensive coverage. Although purposive sampling was used while interviewing specific individuals from the agricultural institutions for the study

By doing the data collection in above said three districts of the state, I was able to compile a comprehensive and systematic picture of the state. It helped me to get an idea about the conditions all over the state as the whole state is represented by these agricultural patterns. The advantage of restricting my study to these three districts across the state was that I was able to save a lot of time and moreover it allowed me to study the nature of problem with better depth. I was able to know the farmers perception and institutional attitude towards research problem.

4.3 Data Collection and Sources

In order to fulfil the goal of my study, data on several aspects of agricultural, socio-economic conditions and resource management were collected. Both qualitative and quantitative types of data were collected, from two main sources: secondary and primary. Primary data was

solicited from the respondents at the village level through questionnaire survey, informal interviews, group discussions and field observations. Documents, reports, published and unpublished books from relevant institutions, departments constituted the main secondary sources of data.

The first step in the process was to review literature on the area. This was done in order to become acquainted with the information available, and to collect relevant secondary materials on the topic and the area where available. This was done in first two weeks of the fieldwork in the districts of Ludhiana, Hosiarpur and Mansa. Short visits to these districts were made prior to data collection to get acquainted with the selected area. The actual field survey commenced thereafter, with the conversations, interviews, questionnaire administration and focus group discussions. The above mentioned methods of data collection were facilitated with the help of community leaders and key informants.

The reason for this multi-method approach, is its rapid and systematic collection or generation of information related to key questions and variables on resource management (Mitchell, 1997). These techniques helped to gain a deeper knowledge about the views and the problems from the point of view of farmers.

The fieldwork was conducted in the summer break from June to early August, which coincided with the rice cultivating season.

4.4 Primary Data

Primary data was collected from local farmers, traditional authorities, opinion leaders and government officials at district level. Primary information was elicited on local farming issues- land use type, Cropping pattern, Size of land holdings, perceptions of environmental problems, level of assistance were some of the variables on which data was collected. Questions were also asked concerning conservation issues. The methods employed to collect primary data are discussed in the following sub sections.

4.4.1 Questionnaires

Questionnaires are one of the most widely used fieldwork methods in human geography. Face to Face interaction forms the corner stone in collecting data. Even though that the quality of data collected can vary enormously from study to study (depending on the complexity and

sensitivity of the questionnaire and on the target sample), the questionnaire survey is an indispensable tool when it comes to primary data collection about people, their behaviour and their awareness levels with regard to agriculture. In this study, data were acquired mainly through the administration of structured questionnaires to respondents. The questionnaires were built according to the information required to fulfil the aims of this research. In-depth interaction through these questionnaires helped me to study subjective meanings and motives alongside the more objectifiable attributes and aspirations that were trapped by structured questions. Questionnaires were structured and composed of two sections. Section A dealt with baseline data about household and preliminary agricultural survey, Section B part composed of more specific agricultural and ecological activities. This section also included questions about economic and ecological aspects. Questions were mostly open-ended and respondents in this case 'farmers' were encouraged to express their own perceptions in their own words. The major input data included land holdings, animal power, labour, canal water, fertilizer, pesticides and capital (separately for tractors, diesel tube wells, and electric tube wells). Land was valued at the average costs incurred per hectare, which include the rental value of owned value; rent paid for leased-in land and land revenues. Any extra income from livestock was computed from the number of animals reared (it was appropriately calculated by multiplying the units of milk by its price). In Punjab major irrigation is provided through tube wells and in some areas by canal water, these two sources of irrigation were recorded to know their specific impact on agricultural patterns. This also helped in getting an idea about the costs incurred on fuels and electricity in case of tube wells.

Capital value was evaluated in terms of their operational costs (agricultural implements and labour). Through the data collection the analysis was conducted for different phases of agricultural changes.

1) Green revolution(1965-73)- The period beginning with the introduction of HYV's (high yielding varieties) and ending up with their widespread adoption, when approximately 85 percent of the wheat area was planted to HYV's. The period was marked by a rapid increase in fertilizer use. Punjab experienced high rates of crop production growth during the Green revolution.

2) Post green revolution period (1975 onwards) - this period is marked with outstanding crop productions. Modern technology like tractors, other agricultural implements became common. This period was marked by changes in crop pattern all over the state. The major change in

crop pattern was in the form of rice crop which once introduced in limited areas spread rapidly through out the state. This period witnessed surplus food grain production by the state.

2) Recent trends (1990 onwards). - A period when fertilizer use levelled off as diminishing returns set in (Sidhu and Byerlee, 1992). This is the time period which is referred to as stagnating period in agriculture. The farmers and farming of the state are facing negative trends in economic and environmental issues. It can be said that Punjab is paying the price for green revolution.

Definitely the use of questionnaires made the data collection more arranged and on specific pattern which helped in coding of data and then doing analysis less complex. During the data collection, productivity estimates in appropriate perspective, major characteristics of the agricultural sector were taken into account.

But while in the field, in many cases the questions needed to be reformulated or adjusted. It was necessary to be sensitive to which questions are relevant and meaningful. Some respondents preferred not to answer the questions directly, so questions were posed around the issue to take a general view from the respondent. The same question may mean different things to different people, due to different background, academic training etc. Therefore questions had to be reformulated in many situations and some even had to be avoided. In some cases, some of the questions were obviously too abstract- or too poorly formulated. The background of the farmers varied from obligatory school and a life as farm farmer and farmer to well educated farmer. Some people were with very less experience in agricultural work. I started out with a detailed questionnaire for farmers. Where appropriate, all issues were followed up, otherwise they were cut down.

The questionnaires were administered in the form of interview, the help of a research assistant was taken who was also an post graduate from the Punjab agricultural university; questions were read and interpreted into more familiar words in the Punjabi language. The use of Punjabi language helped to develop a good working relation with the respondents and the local people in general. Many farmers were enthusiastic about participation in the survey because they wanted somebody to listen to their feelings and concerns. This feeling gave a sense of responsibility while performing the fieldwork.

While starting the questionnaire survey in villages, I introduced myself to the farmers and my purpose of the visit. I had to take them into confidence that this data was only for research and

not for any kind of tax evaluation. I tried my best to be as simple and connected to the farmers as possible and it was facilitated by the fact that my family profession is also agriculture, so it helped me to know many things in advance to the research continuation.

4.4.2 Interviews

The main methodological approach of the study is listening to the relation between the farmers and agricultural institutions and trying to relate them with regard to the objectives of the study. An interview guide to a varying degree was followed for the purpose. Some of the interviews were very structured, especially with the officials of both agricultural university and government department whereas interviews with farmers may be described as informal informant interviews. The longest farmer interview took about three hours including some refreshments and walks around the fields; the shortest some 15 minutes talking about general conditions and weather. Some of the farmers were very open, and these interviews may be characterised as qualitative in-depth interviews.

In general, farmers were easy to interview and often very willing to expose their views and experiences. Farmers were open to their private situation in agricultural and economical situation as they often defined themselves as weak as compared to government and service sector.

Formal interviews with the agricultural professors of the university generated official answers; however, they were friendly in responses about their own institution, problems, and conflicts with other agricultural agencies.

Five public officials were interviewed from both agricultural department and the Punjab agricultural university directly concerning the role of their respective institutions in the agriculture of Punjab mainly their contributions, actions and future plans. Three agricultural officials were interviewed from Punjab Agriculture University at Ludhiana. These officials were agricultural professors from plant breeding department as well as extension and economics department while two officials were from department of agriculture, Punjab government who were interviewed at Chandigarh.

As planned earlier, I kept on noting the interview on the paper and tried to examine them daily. However, with an intensive fieldwork of just two months it became difficult to cope with all modalities.

4.4.3 Focus Group Discussions

Focus group discussions are one of the semi-structured methods of data collection. I carried out three focus group discussions, each in one district. Discussions were conducted along a checklist of structured main topics. The discussions were arranged before meeting and the head of the village was normally present there throughout the course of discussion. During, these discussions, respondents discussed topic relating to agriculture both with me and within them. There were usually around 10 farmers involved in these discussions and used to continue even when we were satisfied with the discussing time. I think, focus group discussions helped me a lot to understand the perceptions and behaviours among the farmers towards the general agriculture and institutions. It also generated important data on useful issues such as farming problems and responses. Interesting fact was that even a lot of farmers were nearly illiterate; still they expressed themselves with confidence and wanted their voice to be heard.

4.4.4 Field Observation

Observation is one of the oldest methods of scientific information collection and reporting. Field visits offer ample opportunities to observe and record information that is visible and direct. Observation is fundamental and critical method in all qualitative research. It plays an important role particularly in qualitative information as it is a supplementary survey to fill the gap left by other survey methods. Participant observation while doing discussions may give important links to the data being collected. It helped me to observe some economic conditions, social and cultural happenings in the place. I being a Punjabi was much comfort for respondents who allowed me to talk openly, often in their houses which gave me the opportunity to use my observation skills. But at the same time, scope of observation feels to be limited as it cannot provide any information about the opinions and attitudes of the respondents. Generally, observation was useful in getting a better understanding of context, cross checking information and possible differences between what people do and what they say. It helped me to explore the group working patterns, social dynamics in the society (social interaction).

4.5 Secondary Data

Secondary data denotes using already existing information, which is not originally collected for the ongoing project; this was generated from published as well as unpublished sources. Secondary data for the study was collected from various sources for the research study. Initially I have been relying on Internet for general overview; I went through the relevant study material from different agricultural institutions but mainly from Punjab agricultural university in Ludhiana, ministry of agriculture, Punjab government and ongoing projects in this field. I also consulted some non governmental organisations working in this field state-wide. I also visited the major libraries at the agricultural university and other departmental libraries.

Data was collected with a high level of detail from secondary sources and the Indian directorate of economics and statistics. The library facilities of Punjab agricultural university and Norwegian university of science and technology as well as other departmental and other institutional sources were used. Emphasis was given to projects and studies which had been conducted in this regard. Maps in the study were taken from websites on the internet. Various relevant websites were used to collect information about the research which particularly played an important role as the present research was area specific and was more difficult to find relevant information while being away from the study area.

4.6 Data Analysis and Presentation

“Data analysis is a process of bringing order, structure and meaning to the mass of collected data” (Marshall and Rossmann, 1995:111). The research conducted uses both primary and secondary methods of data collection. Some of the quantitative data was also collected for accessing the environmental aspect in the study. The data was organised and analysed by the help of Microsoft excel. The data was first loaded into excel sheets before being able to visualize any kind of results or patterns. Because much of the data collected according to the study were descriptive in nature, so they were explained directly, otherwise quantifiable data is presented by the help of tables, bar, pie diagrams and percentages. Figures are regularly used to present relevant variables. The open ended questions were dealt separately.

4.7 Limitation and Weaknesses of the Study

In the study which revolves around economic as well as social aspects, substantial methodological problems can be incurred. While in the field, I also encountered some problems which I would like to present as the weakness of the study.

According to the requirements of research, the questionnaire which was constructed had many questions aiming at getting economic infrastructure of the farmers. On many occasions even after assuring the farmers, many thought that I was from the tax department and were afraid of any kind of negative consequences on their earnings, so there are possibilities that the data particularly relating to economic dealing may be corrupted to some extent.

Other limitations which were felt during the fieldwork are as follows:-

- a) **Time Limitation:** Actually just after preparing the questionnaire and even before leaving for the fieldwork I had an idea that the proposed data collection was quite much in to handle in the given time. But it was only when I went in the field that I encountered many other problems which delayed my progression which includes taking appointments from various officials, going to other districts by arranging transportation, requesting some known people to arrange some gathering for group discussions. It was due to this limitation that I had to almost rush through my data collection especially towards the end of the time frame which certainly affected the quality and quantity of the data collected. It was only after certain period when I realized that research assistant was essential to guide me through the time limit. When the data was finally collected, time constraint was still there as decoding the data and processing it into Microsoft excel was a long time taking exercise. So, I can say that the time at my disposal was not enough for doing justice to extensive data collection that covered both primary and secondary data.
- b) **Accessibility to data:** Accessibility of data was a problem with the secondary data collection. Even after many rescheduling of appointments and many cancellations, agricultural officers seemed none interested in revealing simple facts about the agriculture growth and related themes. The study being done was not covering any confidential matters but still to my surprise officials were quite reluctant to release any information. Despite attempts contacting the agricultural department, I was unsuccessful in getting hold of any form of written agricultural policy of the state. It

was only through some of the known professors in the agricultural university, that I was able to get limited information out of those inaccessible public offices.

- c) Physical barriers: As per my decision to collect data from three different districts of the state, it proved quite a challenge to cover these distances on frequent basis. My home district 'Ludhiana' is situated in the middle of the other two districts one being in the north and the other being in the south. Arranging the transport for the extensive travel which was undertaken in almost opposite directions was itself a constraint to my physical endurance. Some of the villages selected for the coverage were influenced by their easy access just to prevent even longer travels and resultant delays. Coping with this limitation I managed to make my travels as efficient as I could by the help of friends.

Apart from the above mentioned limitations incurred during the research process, there are some other hindrances which also made their present felt. One worth mentioning was the weather during the time of the fieldwork. The temperatures in the state of Punjab during June and July were regularly crossing 45⁰ C mark which made the process of collecting data extremely uncomfortable specially while walking in the village and filling questionnaires.

In the end, I can say that despite all the limitations mentioned it was a great experience specially to mention two months of fieldwork where I learned a lot about the research activities. This study has given me extreme satisfaction which I felt when I listened to the feeling and the problems of the farmers in the field. This study has encouraged me to work more specifically for the betterment of the people and I hope to utilize this experience in further operations.

4.8 Validity and Reliability of Data

Due to the above mentioned limitations this research study has some biases associated with different stages of the study. It is therefore important to assess the degree of objectivity in the conducted study. Reliability is the degree to which the finding is independent of accidental circumstances that affect the accuracy of measurements in the research while validity is the degree to which the findings are interpreted in a correct way (Kirk and Miller, 1986). Validity

helps to assess the justification of applied concepts, measurement levels and data collection method. It also deals with the question that whether the findings correspond with theoretical concepts used the stated problems and the hypothesis if any confirmed or refuted. The concern is that whether the results are able to do justice with the problems undertaken.

Validity is extending to which the procedure gives the desired answer. I analyse that the methods used for collecting the data have justified their application as I have been able to gather enough data for all the principal aspects of the research. Data has been generated in accordance to environmental concerns, social relevance and agricultural practices.

Reliability is the extend to which a measurement procedure yields the same answer, how and when it is carried out. That is whether observations and findings are consistent with other research. Using different methods of data collection was aimed to solve the problem of unreliability. Observation and group discussions, interviews were acting as a cross check for any regularities found during the filling of questionnaires.

4.9 Summary

In this chapter of the study, I have mentioned the methods of data collection which were used in the fieldwork and also have expressed my experiences, some of which were in the form of limitations. It has been explained how by using different techniques of collecting data have been used to accomplish the requirements of the study. The aim was to use both the methods to their maximum use. Primary data was collected from respondents in form of questionnaires which were based on three districts and 12 villages, discussions, interviews and field observations. The secondary data was gathered from institutions of agriculture, documents and reports both within the study area and outside. Different methods employed definitely enhanced the validity and reliability of the data and made it relevant for result analysis.

Mentioned also are the limitations and weaknesses of the study. The research strategy was competent enough to highlight the major findings and laid the foundation for an efficient analysis of the results collected through this data collection. The coming chapter of this research work presents the changing trends in Punjab agriculture over a time period.

Chapter Five

Changing Trends of Punjab Agriculture

5.0 Introduction

Punjab's agriculture has been shifting over the last 40 years but yet it remains a predominantly agrarian economy. According to Punjab government statistics, Agriculture including livestock contributes 44 percent to the gross domestic product and about 70 percent of population in rural is engaged in this profession. The green revolution initiated in mid sixties for wheat and early seventies for rice triggered a high growth trajectory.

The rapid growth in wheat and rice contributed substantially to turn the country from severe food deficit to food grain self-sufficiency in 1975-76. Punjab today produces about 10 percent of the country's rice, 20 percent of its wheat, and about 45 percent of all rice and wheat procured by the government (Punjab development report, 2004). But Economic growth rate has been on the decline since the 1960's, making Punjab one of the slowest growing Indian states during the 1990's. (Singh and Hossain, 2002). Despite, or perhaps because of these achievements, serious concerns are now emerging about the future prospects of Punjab agriculture sector. The growth of agriculture productivity was 5.54 percent from 1966-67 to 1977-78 and 6.52 percent from 1977-78 to 1984-85. It slowed down to 1.56 percent during the period 1984-85 to 1988-89 (Singh and Grover, 1991).

Decelerations in the overall growth as well as productivity per hectare are worrisome. The post green revolution period has witnessed many changes in ecological and socio-economic terms. This chapter examines critical issues regarding these changes over a period of time in the state.

5.1 Pre and Post Green Revolution Era

At the time of the partition of the country in 1947, Indian Punjab was a food deficit state. In 1951, production of food-grains was about 1.99 million tonne only, of which wheat was 1.10 million tonne and rice 0.11 million tonne, 54.4 per cent of total GDP of the state originated from the agriculture sector (Joginder Singh et al, 1997). Although at that time also the cropping pattern was dominated by food grain crops, occupying 68 percent of the cropped

area, yet 38 percent of the area was cropped with pulses and coarse grains, mainly on un-irrigated lands. With net area of 3544 thousands hectare and gross cropped area of 4170 thousand hectare, intensity of cropping was 118 per cent only (Gill et al, 1992). Fertilizers and pesticides were not used by the farmers, Tube wells were conspicuous by their absence and tractors were not much in known in the state. Only 52.3 per cent of the area was irrigated and land holdings were quite fragmented (Lekhi et al, 1986). Soon after the independence, the state started moving on a growth path with mandatory consolidation of land holdings, which was considered a prerequisite for utilisation of canal irrigation water.

According to PAU sources, after the land reforms were set in, irrigated area increased to 54 per cent of the net sown area and intensity of cropping improved to 121 per cent. The cropping pattern was still dominated by wheat with 29.6 per cent of the cropped area, pulses 19.08 per cent, coarse grains 10.52 per cent and cotton with 9.4 per cent of the cropped area of the state. Gross Cropped Area and Net Sown Area increased marginally from 4170 thousand hectare and 3544 thousand hectare to 4732 thousand and 3757 thousands hectare respectively. Productivity of crops started improving but only marginally. But this situation continued with only marginal improvements up to the mid-60s.

The agricultural situation in the state changed dramatically as a consequence of consolidation of holdings, availability of canal water, tube well irrigation and establishment (in 1962) of Punjab Agricultural University with strong research and extension education components that developed close interactive relationship with the state agriculturists. Introduction of dwarf wheat germ plasm and cultivators from CIMMYT Mexico in 1964-65, which could easily stand to higher use of fertilizers without lodging and required assured irrigation, set the stage for wheat-based green revolution in the state.

With this conducive production environment, assured remunerative prices provided by the government through price support and procurement system as well as spread of rural and approach roads network in the state, production and productivity as well as gross domestic product from agriculture sector started improving quite fast. Tractors and tube wells started dotting the landscape everywhere, uses of fertilisers and pesticides expanded and irrigated area as well as intensity of cropping started increasing. Even net sown area also increased.

Cropping pattern started witnessing significant changes. The foundations of the green revolution were thus laid and enabling infrastructural, technological and economic

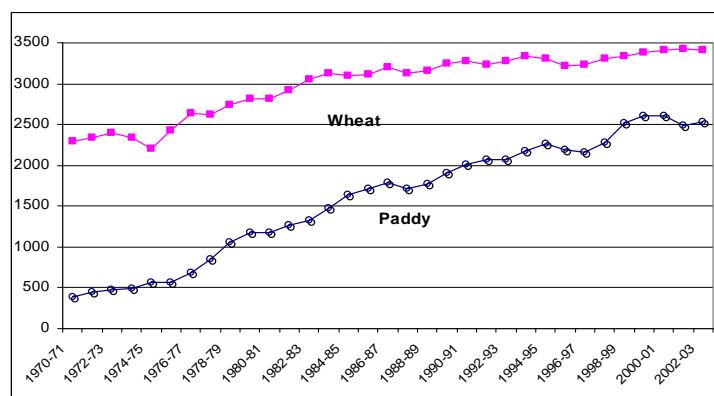
environment was rendered conducive for the interaction of elements of growth and productivity in the state. The green revolution had already started showing results. Dwarf varieties of paddy were introduced and as the result production increased manifold. Net sown area increased from 3.76 million hectare in 1960-61 to 4.05 million hectares in 1970-71. Gross sown area increased from 4.73 to 5.68 million hectare and intensity cropping improved from 121 to 140 percent over the same period.

Cropping pattern underwent significant changes with area under wheat increasing from 29.6 per cent to 40.5 per cent of the total cropped area. Per cent area under pulses declined drastically from over 19 per cent to 7.3 per cent. By this time, new dwarf varieties of rice from IRRI were introduced and the area under rice production started expanding. As a result production of food grains in 1970-71, more than doubled to 7.3 million tonnes from 3.16 million tonnes in 1960-6, with wheat production increasing to 5.15 million tonnes.

Rice had not as yet caught the imagination of the farmers although area under this crop and production had started increasing and the future looked bright. From 1970 onwards agricultural sector growth made a quantum jump. Yet with the industrial and tertiary sector too growing fast, share of agricultural sector in the GDP started declining which was in tune with classic model of growth and development of any economy. This growth in agriculture initiated by green revolution in wheat crop production in late sixties and further fuelled by rice revolution in mid-70s, continued unabated under conducive commercial environment both on production as well as market fronts. Net sown area increased almost to its limit of over 42 million hectares. With cropping intensity of 181 per cent, the gross cropped area increased to over 62 million hectare. In the cropping pattern, wheat occupied 43.7 per cent of the gross cropped area. With rice occupying 28.6 per cent area, the food grain crops accounted for 76.9 per cent of the gross cropped area (Sondhi et al, 1995).

The growth in the area under wheat and rice has increased on a rapid pace. While the area under wheat was approximately around 24 thousand hectares in 1970- 71 and 35 thousand hectares in 2002 – 03, the area under rice has even increased much more. The area under rice was below 5 hundred hectares in early seventies which increased steeply to 25 thousand hectares by 2002 – 03. The graph (1) showing the area under rice and wheat from 1970 onwards is shown below.

Area under Paddy & Wheat crops (000 ha)



Source: (Singh et al, 1997).

The production of Pulses and coarse grains got marginalised. Relative area under oilseeds and sugarcane decreased. Cotton area however held on with marginal, yet fluctuating, increases overtime. During this period, productivity improved dramatically with wheat and rice yield increasing. This conducive economic environment gave impetus to expansion of tubewell irrigation, tractor cultivation and intensive use of fertilisers. Fertiliser use increased from 54 kg per hectare of net area sown in 1970-71 to 265.5 kg per hectare in 1993-94. Pesticides use increased manifold (Kansal et al, 1992).

The number of tractors increased from 10 to 80.3 per thousand hectares of net sown area and tube wells number increased from 192 thousand to 850 thousands in the state. Area irrigated increased from 71 to 93 per cent of the net sown area. The intensity of cropping increased to 181 per cent. Production of food grain increased to 21.58 million tonne, with wheat production at 13.34 million tonne and rice 7.65 million tonne. At present over 84 per cent of the total geographical area of the state stands cultivated and only about 28 thousand hectare land is classified as cultivable waste. This meagre area represents terrain, which are very difficult to cultivate. The state looks like a vast farmstead with only 16 per cent of its geographical area under cities, towns, villages, rivers, canals, roads, buildings, wastes, forests etc. There is, thus, little scope for expansion of crop cultivation horizontally. Vertically, the intensity of cropping is over 181 per cent. There is, thus, hardly any scope for increasing the

intensity of cropping further with the present set of main economic crops grown in the state. So, there have been many changes in the pre and post green revolution agricultural scenario in the state primarily two major aspects, ecological and socio – economic are discussed as below.

In the table (3) below, we can see the major changes in the agricultural items of Punjab.

Important Statistics of Punjab

Item	1960-61	1970-71	1980-81	1990-91	2002-03
Net area (000 ha)	3757	4053	4218	4218	4268
C.I. (%)	126	140	161	178	186
Irrigated area (%)	54	71	81	90	96
Tractors (000)	5	41	125	280	410
T. wells (000)	13	192	600	800	950
NPK (Kg/ha)	0	38	113	163	184

Source: (Singh et al, 1997).

It can be seen above that almost all the major variables involved in agriculture has changed. Among them is the net sown area which is almost touching its maximum limit. As discussed earlier that the cropping intensity has increased due to dual factors of limited land and more intensive cropping adopted by the farmers. These factors hold relevance because they indicate that the basic factors which are responsible for increasing the productions hare already on their maximum utilization level. The other variables shown in the table include the number of tractors, which have lead to mechanization in agriculture. There has been drastic increase in the number of tubewells which give an additional support for irrigation. The use of fertilizers has also increased manifold. So, as discussed and illustrated in this section of the chapter, there have been considerable changes in the pre and post green revolution period in the agriculture of Punjab. In order to understand the changes in a better way, this chapter has been

divided into two principle perspectives, the ecological and the socio- economic. The ecological perspective is as follows.

5.2 An Ecological Prospective

5.2.1 Ground Water

Water is life. Both the natural and human systems are critically dependent on water. It is the primary requirement for not only the survival of human beings, but also for their socio-economic development and a healthy ecosystem. In addition, access to water plays a critical role in poverty alleviation and food security, both local and national. The prevailing trends towards rising population, increasing urbanisation, spread of more water intensive life styles as well as agricultural technology sweeping around the world are going to make water resource even scarcer unless timely action is taken. How to manage water has thus emerged as one of the great challenges of the 21st century.

Attempts to minimise wastage and conserve water through more efficient management of irrigation systems at both macro and micro levels have to be pursued with renewed vigour. There is an overriding need for sustainable development and sound environmental management of water resources. The aim should be towards sustainable long-term resource enhancement rather than mere short-term exploitation by strictly observing environmental considerations.

There should be increased understanding of interaction between groundwater and food security at different levels. The existing cropping patterns adopted by farmers have led to overexploitation of ground water and decline in water level as a consequence.

During the last three decades, there has been a rapid decline in the ground water in Punjab except a few areas of south-west region, High water requirements for paddy cultivation especially in the early transplantation period is also largely responsible for lowering water table (Grover et al, 1990). The introduction of paddy in the state was made about 50 years ago to reclaim waterlogged and salt-affected soils. Subsequently, because of profitability, paddy replaced maize, groundnut, pulses and cotton crops.

Due to increase in cropping intensity, the traditional pattern of cropping was forgotten and fields are under cultivation for almost 10 months a year. This also contributes to over – exploitation of groundwater, till now the major source of irrigation.

According to a study by (Hira, 1997), out of the state’s area of 5.03 million hectares, 4.32 million hectares has a falling water problem. The State of the World Report, 1998, published by the Washington-based World watch Institute, says the gap between water use and sustainable yield of the aquifer is so high that the aquifer under Punjab could be depleted by the year 2025. According to K K Mehta, (Regional director of Central Ground Water Board, Chandigarh), "In almost half of Punjab, the depletion of water resources is leading to a crisis,”

The crop intensity has increased in the last 30 years, directly putting more pressure on the natural resources available for agriculture. There has been a significant change in the cropping pattern over the state; the table (4) below depicts the shifts in crop pattern in Punjab.

Shift in crop pattern				
Crop	1960-61	%	2002-03	%
Rice	227	4.80	2530	31.86
Maize	327	6.91	152	1.91
Millets	140	2.96	7	0.09
Groundnut	67	1.42	4	0.05
Cotton	446	9.43	449	5.65
S. Cane	133	2.81	142	1.79
Pulses	32	0.68	28	0.35
Wheat	1400	29.59	3404	42.87
Barley	66	1.39	23	0.29

Source: (Singh et al, 1997).

From the table above, we can see the shift in the cropping patterns. Rice which was occupying only 4.80 percent of the total crops in 1960-61 increased substantially to 31.86 percent of the total crops by 2002-03. On the other hand, wheat increased its dominance from almost 30 percent to 43 percent. With the increase in the dominance of these crops, other crops have seen decline in their area. Maize which is the next important crop has declined from 7 percent

to 2 percent. Similar was the case with other crops like millets, cotton, and sugarcane. Pulses and groundnut is almost disappearing from the agricultural fields of the state. These shifts are important for ecology because, the crop pattern influences the extraction of ground water which forms an important part of the irrigation availability for agriculture. This shift in crop pattern assumes even more significance because it is the irrigation of rice crop which is responsible for extraction of ground water in large quantities. Ground water is pumped up by the help of tubewells both while making nursery for the crop and for the transplantation as standing water is needed for the growth of rice crop.

There have been many studies depicting the groundwater situation in the state of Punjab. Study about ‘water resource development and management for sustainable agriculture production in Punjab’ by (Narang et al, 1995) shows that the total water resources available excluding ‘unfit’ and ‘marginally fit’ water in the state are 3.13 million ha-m as against the water requirement of 4.377 million ha-m, making a deficit of 1.247 million ha-m. The ‘unfit’ water is here referred to as the brackish water found in the south-western districts of the state which is not considered well enough for agricultural purposes.

Another study ‘On farm water management’ by (Sondhi and Khepar, 1995) shows that area under different water table depths in various districts during the last 20 years(June, 1973 and June, 1994) is shown in table (5) below. It may be seen that area under water table depth less than 5 meters has been reduced from 37.5 to 18.3 percent, while area under 5-10 metre depth has increased from 42 to 50 percent. Similarly the area under water table depth more than 10 meters has increased from 20.5 to 31.7 percent. Thus except in certain pockets of south western Punjab, water table has been steadily declining since after the spread of rice cultivation in Punjab in 1970’s.

Table (5) showing area (ha) under different water table depths

District	< 5 meters		> 10 meters	
	June 1973	June 1994	June 1973	June 1994
Amritsar	220700	41600	24000	49100
Bathinda	137900	148900	252000	98600
Faridkot	153700	257000	198700	105300
Ferozpur	385600	127000	160000	34000
Gurdaspur	184000	118700	82100	67000

Hosiarpur	62700	65500	187900	138100
Jalandhar	89900	Nil	18500	190900
Kapurthala	96600	11300	Nil	37800
Ludhiana	97500	72000	16700	173100
Patiala	215900	4000	10300	300200
Ropar	47600	68800	81400	67800
Sangrur	198400	6000	Nil	331700
Total	18,90,500	9,20,800	10,31,600	15,95,600
percent	37.5	18.3	20.5	31.7

Source: Sondhi and Khepar (1995)

According to ground water assessment (1992), out of 118 blocks in the state, there are 63 blocks in which extend of over exploitation is more than 100 percent of annual net recharge. In addition, there are 7 blocks in which the extend of exploitation is above 85 percent. Of the remaining 38 blocks, 15 fall in grey category with 68-85 percent of net annual recharge to groundwater, leaving thus only 33 blocks in the white category. This over exploitation is due to the increase in the number of tubewells from 1.92 lakh in 1970-71 to 8.70 lakh in 1993-94 (Sondhi and khepar, 1995).

It has been estimated that by replacing about 5 lakh ha under rice crop in selected areas, with maize, groundnut, pulses, soyabean and bajra fodder, about 77.5 thousand ha m water can be saved table(6) showing effects of replacement of rice crop on water balance

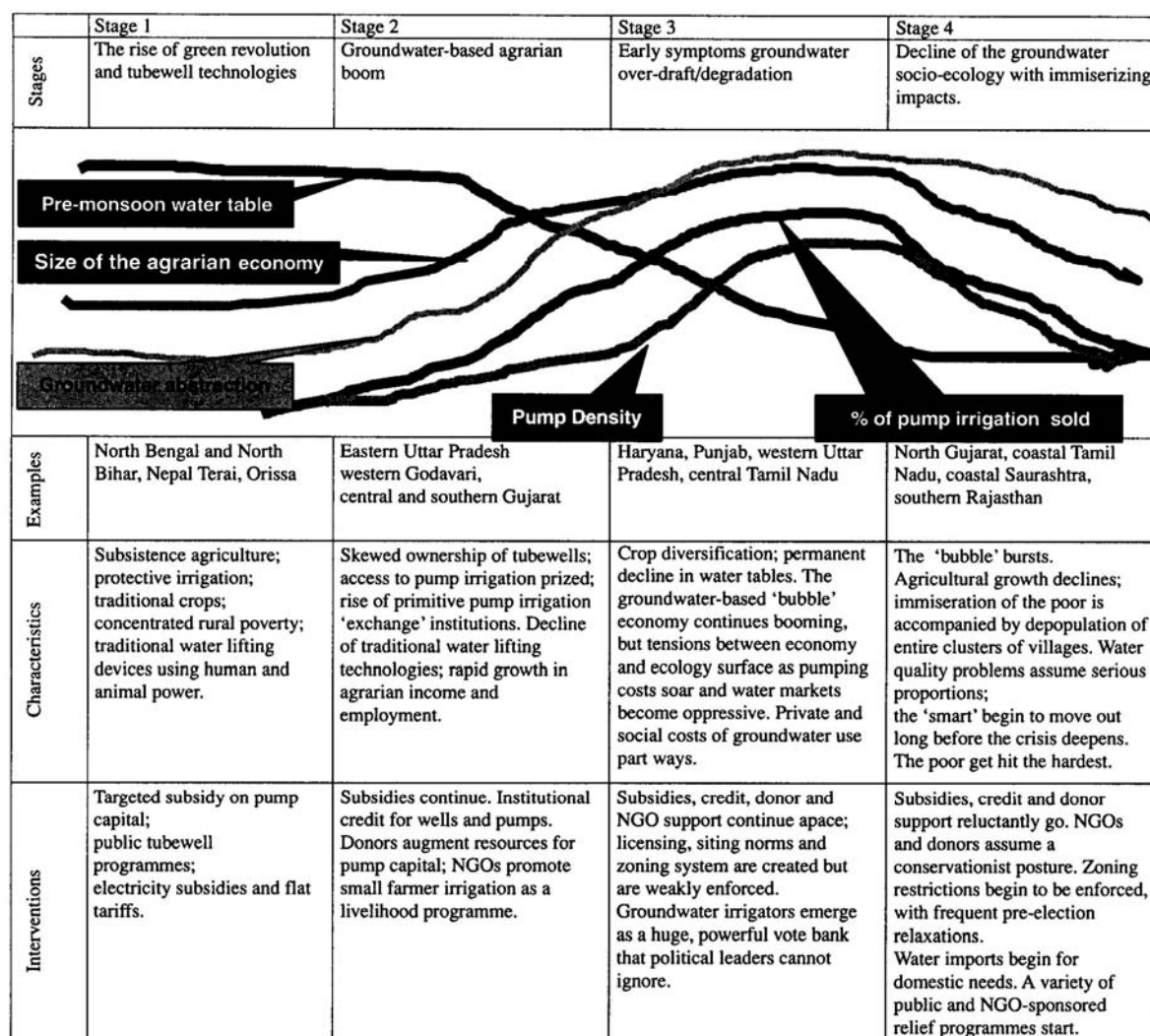
Replacement crop	Area (000 ha)	Irrigation water required (000ha-m)		Net amount of water saved
		Existing	Alternative	
Maize	250	182.50	150.00	32.50
Groundnut	50	36.50	25.00	11.50
Kharif pulses	50	36.50	22.50	14.00
Soybean	50	36.50	30.00	6.50
Chari/bajra fodder	100	73.00	60.00	13.00
Total	500	365.00	287.50	77.50

Source: (Sondhi and Khepar, 1995)

This can reduce the exploitation of ground water by rice crop whose continuous extension of cultivation on more and more sandy soils as well as because of intensity of cropping is responsible for increasing the gap between water availability and its requirements for irrigation purposes in the state.

Another study conducted is 'sustaining Asia's groundwater boom: an overview of issues and evidence' by (Tushar et al, 2003). He has explained the situation of Punjab and the consequences which could happen if the trends continue.

The situation of Punjab in the context to present problem is explained below in the form of a figure (2).



Source: (Tushar et al, 2003).

As we see from the diagram, the state of Punjab is kept in stage 3 which shows early symptoms of groundwater over draft. The stage 1 refers to the period of 1970's in the state when the green revolution was ushered with the characteristics of importance on traditional

crops with the rise in irrigation by tubewells. The stage 2 refers to the splendid results of green revolution with rise in productivity of crops and income. The stage 3 where the Punjab state is presently kept is characterised by steep decline in water level, and the tensions between economy and ecology have started to surface. The groundwater pumping costs increase rapidly as the farmers have to deepen their tubewells after short spans to meet the declining water table. Size of agrarian economy is high, that shows the state economy is dependent on agriculture, so it will have an adverse effect on the economic level if there is ecological disaster like water level depletion in coming years. The groundwater extraction worm is at its highest position in the stage 3 showing the imbalance between the recharge and extraction.

Once this stage is crossed, it leads to total collapse of the ecology and thus of economy. Water level decline has been one of the major ecological changes in the post green revolution period in Punjab.

5.2.2 Burning of Paddy Straw

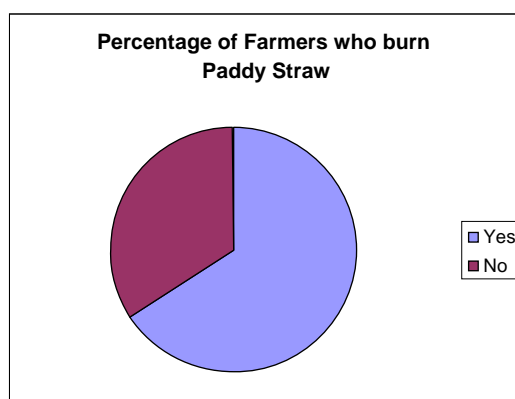
Apart from water being one of the most sensitive links of the ecological prospective, another issue has been the burning of paddy straw. Paddy straw is the part of the rice crop which remains standing in the field after the rice is harvested. It is needed to be cleared from the fields before anything else can be grown in the same field. As the area under rice has increased since the advent of green revolution, the problem of paddy straw burning has also increased alarmingly.



Picture above shows the paddy straw burning and the resultant thick smoke generated.

The 16 million tones of rice straw that is burnt every year (Punjab development report, 2004) results in air pollution, creating suffocating smog like conditions in most parts of the state at the time of rice harvests.

During the fieldwork survey, question was asked to find out the percentage of the farmers who burn the paddy straw. It was found out that 68 percent of the farmers said yes that they burned the straw of paddy while 32 percent of the farmers used it in some alternative ways. It has been displayed in figure (3) below.



Source:fieldwork, june-2004.

This percentage is considerable keeping in mind the health hazards caused due to smoke emitted as the result of burning of paddy straw. Burning of the paddy straw not only causes smoke clouds but is also harmful for the soil microbial activity. This is resulting in increased levels of carbon monoxide, carbon dioxide, methane, nitrogen and other gases, which caused a lot of air pollution. It forms clouds of smog, which could not easily be dispersed away.

But the most surprising fact which came to light during the group discussions was that, majority of the farmers gave the reason that they did this practice in order to save time and due to lack of knowledge about how to handle or mange it. University authorities upon contacted said that there were several available ways to use this straw like processing crop residues, potential forestry, and grasses to produce card board, paper and plywood but declined to give any reason behind not been able to convince the farmers to use paddy straw in a better way.

Another kind of pollution is caused by disposal of livestock waste in the state. Upon surveying it was found that 58 percent of the farmers used the waste of livestock for burning

as a fuel which causes a lot of smoke and possibly respiratory problems. Only 38 percent of the farmers were using this waste as farm yard manure while only 4 percent of the farmers used it in the gober gas plants (a plant where animal waste is used to prepare cooking gas by the action of bacteria).

5.3 A Socio – Economic Prospective

The state has undergone many social and economic changes during the period of post green revolution .It is beyond doubt that the economic condition has improved in terms of materialistic items. During the survey, questionnaires were used to get the data relating to social and economic parameters. In order to have a better idea of the changes, time series of 10 years was adopted for many social and economic issues. These changes will help to build up the relationship between the agricultural stagnation and the socio-economic conditions of the farmers in the state. Below are the results which were collected during the fieldwork in process of household survey.

Farmers were questioned about the below selected household materials and were asked about their possession both presently and approximately 10 years ago. It was seen that there was considerable improvement in the household materialistic goods possessed by the farmers². See Appendix I. This increase in the household possession can be interpreted in two ways;

Firstly it can be seen as the general increase in the domestic expenditure by the farmers, which could eventually lead to more economic burden (keeping in mind that majority of the farmers belong to small farmer category). In order to meet these household expenses the farmer is most likely to take loans and thus can land in the vicious circle of loans and debts. The reason for going in for these materials is often associated with personal prestige in the society or potential show off.

Secondly, this trend of increase can be seen as a result of improved alternative incomes apart from agriculture. In other words stagnating agriculture can be seen as a blessing in disguise for these farmers because some of the small farmers had actually tried to move out of agriculture by aliening themselves with other secondary activities, so as the result started receiving some kind of secondary income. In a way this trend is encouraging for the farmers and farming of the state.

This trend can also be related to one of the findings, according to which 84 percent of the farmers reported that they would not like to engage their next generation in agriculture if they were given alternative choice of profession.

Farmers were asked about their exposure towards the Mass media. This question was included to know about their exposure to new things in agricultural scene or social. Farmers were asked about their exposure level to different sources of knowledge. It was found that, television and personal contacts are the two largest sources of knowledge to the farmers in villages. 55 percent of the farmers said that they watched television everyday for news and agricultural related programmes. Different responses in percentage are shown below in table (7), below.

Source	High exposure	Moderate exposure	Low exposure
Television	55%	19%	26%
Radio	8%	32%	60%
Newspaper	27%	41%	32%
Personal contacts	54%	11%	45%

Source: field work, June- 2004.

This section holds importance because; it deals with the different economic and social symptoms of the farmers which are crucial to know in order to find out that if there are any socio-economic reasons behind agricultural stagnation.

5.4 Summary

Punjab agriculture has gone through many changes; both ecological and social perspectives have been discussed above. Ecological changes were broadly classified into decline in water level and burning of paddy straw. Socio- economic changes were taken into account by the help of detailed data on households. These changes will form the basis to know if there are any ecological or economic reasons behind agricultural stagnation in the coming chapter. This information from the questionnaires cannot be seen an independent in itself but the study will help in interconnecting the relations between different factors. The next chapter of the study deals with the actual issues dealing with agriculture.

Chapter Six

Agricultural Stagnation: An insight view

6.0 Introduction

Much of the Punjab's growth slowdown originated from the agricultural sector- its output grew at the trend rate of 2.6 percent per annum in the 1990's compared to the all India average of 3.2 percent, and almost half of the growth rate of 5 percent per annum in the 1980's (Punjab statistical department). Worse the current agricultural practices seem to be environmentally unsustainable. Punjab now has the highest percentage of ground water exploitation in the country and also the largest percentage of over exploitation and dark blocks (Punjab development report, 2004). It seems that the prolonged dominant monoculture of wheat – rice has now resulted in deceleration of agricultural growth as well as productivity per ha. All these factors play a crucial role in determining the agricultural future of the state. This chapter looks at the some of the results which were determined by the fieldwork study relating to agricultural stagnation.

6.1 Land Use

Land is one of the most important natural recourses. The magnitude of agricultural activities largely depends upon the quantity and quality of land resources and the manner in which they are utilized. The state lacks in terms of minerals but having location advantage of water availability, levelled land and appropriate climate, the entire land is virtually made fit for agricultural purposes. Another utilization of land lately has been covered by forests.

Some other options like social forestry could have been adopted. The forest area in the state is concentrated mainly in semi- hilly tracts of Hosiarpur, Ropar and Gurdaspur districts. Though social forestry is not profitable as compared to common crops, except in case of marginal lands, yet plantation can be done vigorously (Chatha et al., 1986). The kandi belt of the state has vast potential of plantation especially the traditional forest and fruit trees. Land utilization has important ecological implications. The changes from one land use to another are often made to achieve better economic use of land resources. However , many changes have detrimental effect on the natural environment, i.e., conversion of pastures into agricultural land , industrial sitting in prime agricultural area, increase in urbanization land use plans, the potential environmental conflicts between adjacent land uses should be given due

consideration. Due to absence of any other major utilization of land, agriculture remains at the forefront. Therefore the dependency on productivity from agriculture assumes much significance.

6.1.1 Crop intensity

The increase in cropping intensity and decline in uncultivable and barren land provide land with vegetative cover for the most part of the year and no doubt it has benefit of checking the wind erosion and water erosion but at the same time it leads to the immense pressure on the land and soil nutrients available for agriculture. The land is hardly left fallow and the crops are grown in quick succession preventing the enough airing of the soil and replacement of the natural contents of the soil in the farms. As the further expansion of area horizontally is extremely limited in Punjab, it has lead to intense cropping on the land.

During the fieldwork, it was found that majority of the farmers actually planted new crops as soon as they could cultivate the land and there was no time left for land to regain its fertility. Most of the farmers were of the view that due to the extreme limitation of the further expansion of horizontal area and grabbing of cultivable fertile land by urbanization and other activities like highways, it has become impossible to keep the land uncultivated even during the period between two major cropping seasons. This continuing practice over the years has lead to major deficiencies in the soil health (Gill, 1993). The issue of crop intensity is important because in order to regain the nutrients of the affected soil, artificial fertilizers are needed which also add substantially to the overall cost of inputs in agriculture. So as the result, increase in crop intensity on one hand leads to pressure on soil health, on the other hand it puts the economic strain on the farmers.

6.1.2 Farm size

Due to the increase in pressure of population on land, the number of small holdings is increasing. As there is no lower limit for land holdings in Punjab and also lower upper limit for large farms, land holdings are getting to a scale where the agriculture can become unprofitable. These small farms also generate barely small incomes and therefore due to low incomes, these farmers are not capable to generate internal capital formation which is

necessary for their growth. According to (statistical abstracts of Punjab, 1985), the farm size distribution in Punjab is given below.

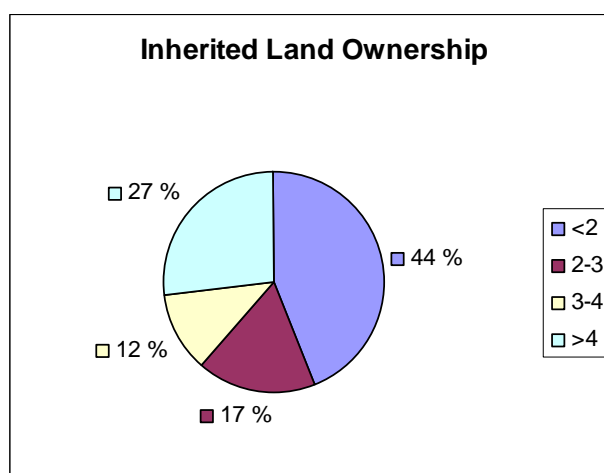
Table(8) showing farm size distribution in Punjab

Category	Farm size(ha)	Farms percentage(1985-86)
Small	<2	42.63
Semi-medium	2-3	16.83
Medium	3-4	9.89
Large	>4	30.65

Source: (Statistical abstract of Punjab, 1985)

In order to look at the details in the chosen districts, questions were asked from the farmers regarding their ownership of farms. During the data collection enquiries were made about the inheritance of land and the present ownership of land by farmers in the three districts. These two aspects of land ownership were considered to get an idea about the changes in the farm size over a span period of one generation.

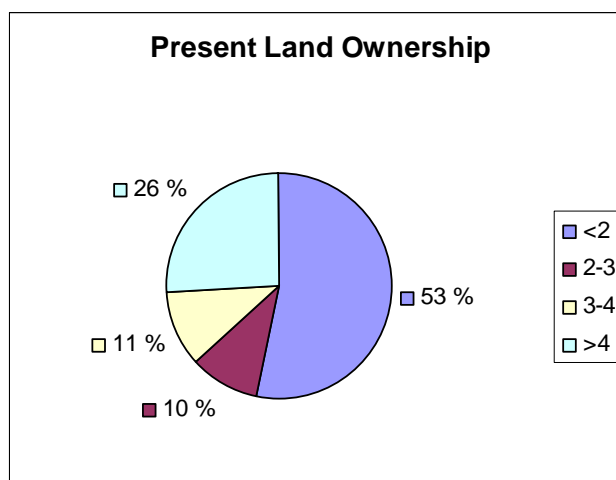
Below is the pie chart, Figure (4) showing the inherited farm size (acres) by the farmers in study area.



Source: fieldwork, June-2004

To compare the changes in farm sizes, present land ownership was also recorded and is as below. It was found that the farms up to 2 acre comprised 53 percent of the total number of farms in the three districts from where the data was collected. The data from the ministry of Punjab shows that this percentage has been increasing from 1980-81 onwards whereas the

percentage of large farms is on the decline. Below is the pie chart (figure 5) showing the present land ownership.



Source: fieldwork, June-2004

Therefore, there is necessity not only to check the increase in population dependent on agriculture, but also to withdraw population from agriculture by opening up alternatives employment opportunities. Also, liberalization of the land lease market by protecting the interest of land owners could go a long way to increase the farm size of small farmers by lending in from medium and large farmers who should be willing to do so (Kalkat, 1996; Randhawa, 1996). A degree of protection in land lease is important for farmers because it gives them the sense of security about their own land.

While asked about the reasons for selling their own land, 30 percent of the farmers said that they had to sell their land due to social obligations like arranging dowry for girl marriages, maintaining status in the society. Another 30 percent of the farmers pointed to the indebtedness beared by them as the main reason for selling their land. They sold land in order to repay their debts or to keep their land as security with rich landlords in order to obtain more loans. Rest 40 percent of the farmers who sold their land had varied reasons to their action like majority of them used the money collected by selling their land to migrate abroad in search of greener pastures.

6.2 Farm Machinery

In the questionnaire, it was tried to get data relating to procession of farm machinery by the farmers. Data was collected on the basis of time series to get an idea about the nature of changes in the farm equipment. Questions were asked about certain implements which are used in the agriculture in Punjab. This list of equipments was prepared by keeping in mind the level of usage one can get out of them. There were certain equipments which were supposed to be used only on a certain limit of land or on specific crop patterns.

The data revealed the below tabulated (9) results.

Farmers possessing	Presently	10 years back
Tractor	74%	44%
Trolley	62%	39%
Combine	4%	1%
Thresher	16%	6%
Harvester	6%	2%
Seed cum Fertilizer drill	23%	6%
Electric motors for irrigation	72%	45%
Diesel motor for irrigation	75%	70%
Cultivators	38%	9%

Source: fieldwork, June-2004

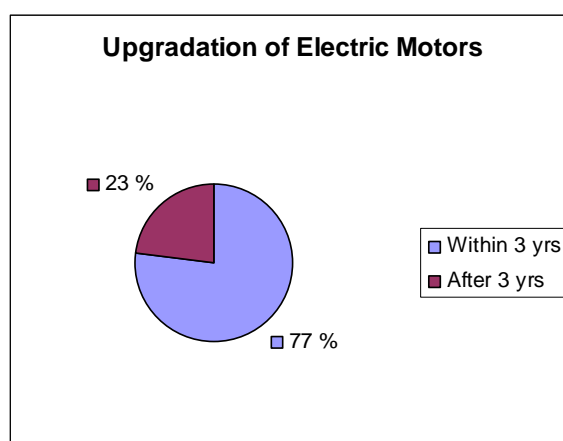
It was found that the farmers presently having tractors were 74 percent as compared to 44 percent about 10 years ago. This shows tremendous percent of increase especially when we take into account the decreasing farm size in the state. Upon relating the data with the farm size of the respondents, it was found that about 60 percent of the farmers who had land below 2 acres possessed a tractor. It was bit surprising.

In order to investigate the reasons, this matter was taken up in group discussion with the farmers; it was only then, that they revealed some of the reasons. The primary reason which was given by farmers was more related to self respect than to agriculture. Farmers had a notion that it was better to buy their own machinery rather than to rent it from other big

farmers. They cited that they didn't want to be dependent on other farmers for their equipment. These behavioural characters can be seen as major reason for even small farmers to go in for their own equipments. Moreover owning a tractor has even become as a status symbol, so every farmer irrespective of his holding s, tries to own a tractor for agriculture as well as for show off.

Similarly, the ownership of trolleys has increased from 39 percent to 69 percent. The trolleys are mainly used to carry the produce to the common place of selling (mandis). According to experts in agricultural university, a single trolley could be actually used by many farmers to bring their produce because even if the crop is harvested ta the same time, all the farmers cant carry their produce together to mandis due to lack of shelter and space for their produce. So, investment in trolleys is just not productive unless it is used for other transportation purposes.

Electric motors have increased by 27 percent. This increase is linked with the growth of rice cultivation as it needs more water, which is complemented with the installation of these motors. It was found that farmers spend a lot of their money in upgrading these motors almost every alternative year. More than 77 percent of the farmers reported that they had to deepen the underground motors (which pump the water up from surface) within the span of every three years. Below is the pie chart (6) showing the time span in percentage for up gradation of electric motors.



Source: fieldwork, June-2004

Upon investigation it was found that it required a substantial amount of money and time for this process. So, this factor also played its part in increasing the investment in the agricultural sector.

Although the growth of diesel engines is not high but the farmers claimed them too as a reason for increasing their production costs. Although electricity for irrigation is comparatively cheaper than using diesel, the supply of electricity for agriculture is becoming scarce every year due to more demand than production capability of the power in the state (there are not many opportunities to produce either hydropower or thermal electricity). Due to lack of electricity, they have to depend on these diesel engines day and night to meet the requirements of water for irrigation. Secondly partly due to steep increase in the prices of diesel over last years had put much more burden on the farmers as it leads to increase in the input costs.

Increase in percentages of other equipment can be attributed to the use of new cultivation methods in the state.

6.3 Production pattern:-

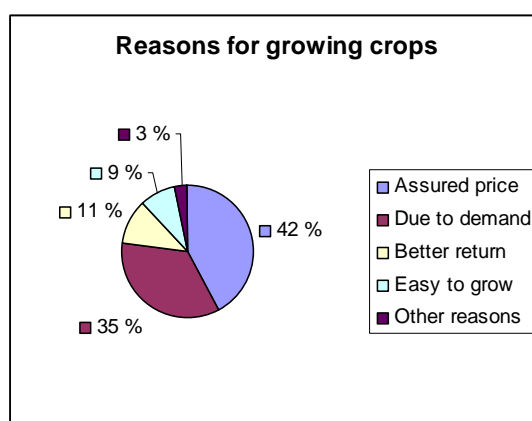
Just after independence, the country was in the grip of severe food shortages in spite of heavy imports of food grains. Thus, the priority of the nation was to lay the more stress on production of cereals. The state of Punjab took the lead in making drastic changes in the crop pattern apart from pushing up the productivity of various crops. During the fieldwork, it was aimed to know about the production pattern in the three districts and also the possible reasons behind these patterns.

6.3.1 Crop pattern

Rice which occupied only 6.04 percent of total cultivated area in 1960-61 registered a steep rise up to 52.62 percent in 1995-96 (Statistical abstracts of Punjab, 1996). In this section, I wanted to know that if there was any relation between cultivation of rice-wheat pattern to the conditions of the area either physical or any other? During the fieldwork, it was found that rice-wheat pattern was dominant all over the three districts, though out of the three selected districts only Ludhiana was actually having conditions as favourable soil for rice cultivation, However districts of Mansa and Hosiarpur also had almost the same number of farmers who followed this specific kind of crop pattern. Known the facts that the soils in Mansa district are sandy and not very viable for rice cultivation, also in the district of Hosiarpur which is situated in the foothills of Himalayas, the terrain is not very favourable for rice cultivation.

In order to get the reason behind their following of this pattern, farmers were asked to give reasons for growing their specific crops, (which was rice and wheat for majority) to make it easy for them and to get an even more insight in to the reasons, I gave them some options to select and also one there was an option for them to write any other reason.

Among the choices in the answers were 1) Assured price 2) due to their demand 3) better return 4) easy to grow 5) other reasons. Below are the results which are interpreted in form of pie chart (7).



Source: field work, June 2004

Assured price was the first reason for farmers to adopt wheat-rice crop pattern. Because of the government policy of procurement, minimum support price is settled and all the produce is bought according to the fixed price. Farmers feel a sense of security while sowing these crops knowing that they will one day reap into returns. Second largest percentage was attributed to the reason of demand. Farmers were of the view that once they grew these crops, they were able to sell them fast because the government has the basic infrastructure to procure it easily and fast as compared to other crops. Better return was the reason for 11 percent of the farmers because they thought that these crops were more attractive in terms of monetary gains. 9 percent of the framers were adopting this pattern due to the easy approach while cultivating them. They were of the view that once the rice or wheat is grown, they didn't had to care much about the crops until they are ready for harvesting but in case of crops like maize, they had to actually be on constant vigil against crop damage by animals or by human activity. They considered rice wheat pattern as comparatively risk free. The comparative economics of various crops enterprises and the associated risk in production and marketing are the factors to determine the choice of crops in the production plan. The effective price support was given only to paddy and wheat. Therefore the agriculture in Punjab is heading towards

specialization even though serious concerns have been expressed time and again for diversification of agriculture

From the above trends which are as the result of questionnaire survey, I have been able to analyse the reasons behind much talked and criticised crop pattern in the state. It is often, that farmers are blamed for sticking to this pattern but this study reveals that it is not only that farmers adopt this pattern for their easy approach but it is the integration of other factors which lead to present cropping mechanism. It involves a role played by the government, although it requires a study like this to explore that insight view.

The emerging cropping pattern has not only high requirements of underground water, diesel power, fertilizers and pesticides, but has also disturbed the soil structure by puddling. Puddling is the practice of making the soil ready for paddy cultivation. As an effect of paddling, the water does not percolate through the soil and it also affects the soil by changing its natural structure. Puddling of the soil results in dispersion of soil particles. The dispersed clay moves down into the soil and clogging of pores reduces permeability of water. This also causes the formation of plow sole (hard pan) at about 20-25 cm depth in the soil. When the soil is kept submerged during the growing period of rice, the physical-chemical and microbiological environment of the soil are altered (Singh, 1992). Rice cultivation increases the bulk intensity, modulus of rupture and dispersion ratio (Singh, 1992).

The wheat rice pattern has lead to many ecological changes (Singh et al., 1990). The increase in area under wheat is at the cost of gram and oilseeds, while that under rice at the cost of maize, groundnut, pulses. Also, with intensive cropping, the area under leguminous crops has decreased (singh, 1992). The leguminous crops formed an important part of cropping system before intensive cropping came in. The leguminous crops are capable of fixing atmospheric nitrogen and are deep rooted, thus they replenish the nutrients to some extend. (Bijay et al, 1991) demonstrates that inclusion of a legume green manure crop in the cropping sequence has improved the potential of soil to sustain high yields in addition to saving nitrogen and taking care of micronutrient deficiencies.

6.4 Water Resource Management and Development

Water is an essential constituent of human, animal and plant life. It is a renewable natural recourse but there is an upper limit to the availability of water in the area determined by annual accruals through inflows and rainfall. Huge investments have been made to exploit this resource for sustaining the irrigated farming. The efficient management of water demands that

the maximum portion of precipitation receipts are used for vegetation and that the minimum of this goes as seepage, run off or merely as evaporation loss.

The spectacular increase in agricultural production in the Punjab state has been made possible due to expansion of irrigation network initially through canals and through widespread use of tube wells. Only 54 percent of the net sown area was irrigated in 1960-61 which increased to 95 percent in 1995-96. The area irrigated by tube wells numbering 0.88 million is 62 percent and the remaining 38 percent is mainly by canals. The area irrigated by tube wells has increased by nearly three times over that of 1960-61 (Statistical Abstract of Punjab, 1980-1996). The area irrigated by canals varies from year to year, which adds to already high degree of uncertainty in agriculture.

The aim of this section was to know the extend of decline in water table in these three districts and to what extend it was hampering their agricultural practices. The fact that water for irrigation is an important variable was clear when 56 percent of the farmers questioned characterised it as a high constraint which is experienced by them.

The farmers in different districts gave the details of changes in water table. The changes in water table were broadly consistent showing sharp declines, within the districts except in Ludhiana district where one of the villages surveyed reported unusual moderate decline, possibly due to its proximity to the river Sutluj which passes through close proximity. The decline as reported in three districts is as follows.

Table(10)

Districts of study area	Water level (meters)	
	Approximately 10 yrs ago	Presently
Ludhiana	10-15	45-55
Mansa	5-10	30-40
Hosiarpur	10-15	40-50

Source: field work, June-2004

The low figures corresponding to Mansa district are due to the reason that this district was probably the last district in the state to switch over to rice cultivation because until early 90's cotton was the main crop of the district but its cultivation was discouraged by widespread disease.

When asked about the problems asked due to decline in water table, majority of farmers attributed this reason for the increase in input costs.

Another discovery was that almost all the farmers were aware of the declining groundwater problem and it reasons but they pleaded helplessness to change the situation.

The over exploitation is bound to increase further, on account of continuous extension of paddy cultivation on more and more sandy soil as well as because of increase of intensity of cropping. The over exploitation has mainly been caused with the manifold increase in the area under wheat and rice, high water requiring crops, particularly and predominantly wheat – rice rotation. Therefore, the prevalent production pattern does not seem to be sustainable in the long run.

6.5 Pest Management

The pest problems in Punjab agriculture have undergone a tremendous change due to the adoption of green revolution technology. The widespread cultivation of short statured high yielding varieties, increased use of nitrogenous fertilizers, pesticides and irrigation, has accentuated pest problems. Some of the minor pest has become major, whereas several major pests have become resistant to commonly used pesticides. (Singh and Dhaliwal, 1992a; Dhaliwal and Arora, 1993).

Pesticide usage by farmers: surprisingly, 82 percent of the farmers have reported insects/pests as high constraints in agriculture and diseases was reported as high constraints by 83 percent farmers. Due to the problem of pest, there is also a threat to the ecological equilibrium and economic viability of cotton, the main cash crop of the southern district of Mansa region. Farmers expressed their inability to grow cotton anymore due to more pest problem for the crop in recent years. Problem of weeds was also significant among farmers of all districts as 71 percent of the farmers considered it as high constraints.

Pesticides are poisonous chemicals and the farmers lack the knowledge of their proper use. During the focus group discussions in the field, farmers revealed that they usually purchase pesticides from the commission agents on loan which could lead to agents advising the farmers to purchase unrecommended pesticides to promote their sales, use them at lower doses or at longer intervals to reduce the cost of application. Particularly the farmers in the Mansa district were affected some ten years ago when major outbreak of pests affected the

cultivation of cotton, then the major crop of that area. The relevant department in the Punjab agricultural university attributed that epidemic pest appearance to the large scale cultivation of unrecommended susceptible varieties, choice of wrong insecticides and dosages longer spray intervals, indiscriminate and excessive usage and reduced efficiency of some insecticides. Whereas in the district of Ludhiana, farmers complained about the stem borer problem in rice cultivation and majority of them expressed unawareness about the possible reasons, however, the university officials reported this problem as caused by early transplantation of rice by the farmers. Surprisingly, the university recommends the planting of rice not before late June or early July but according to the information gathered during the fieldwork, it was revealed that more than 80 percent of the farmers had the tendency to start plantation by as early as May.

Early plantation like this does not only cause diseases for crops but it leads to excessive evaporation during the months of May and June. Much more quantities of water are needed to compensate evaporation as compared to cultivation which is undertaken during the month of July, when irrigation is supplemented by monsoon rains.

6.6 Agro Industrial Developments

In the pre- independence period, Punjab state was economically backward with traditional agriculture. The partition of the state in 1947 gave a serious blow resulting in most of the industrial establishments and raw material supplying areas left in Pakistan. The economy was completely shattered due to acute shortage of capital and infrastructure. The fear of partition was so deep that every entrepreneur was reluctant to invest in this border state.

Agro industries can play a long part in reducing the pressure on land. Farmers in Ludhiana district were of the view that more sugar mills should be build in the district so as to explore the possibilities of sugar production which would result in timely procurement of their produce. During the fieldwork it was found that large scale agro- processing facilities in the organised sector are virtually non existent. Presently these perishables are produced primarily for the table purposes and lack the required quality parameters for their processing and preservation. The policy for rapid industrialization has to be based on the industrial potential of the state. During the discussions, it was felt that farmers were mentally ready for such an approach especially in the district of Hosiarpur where farmers expressed their views in the positive direction. Majority of the farmers who once started to explore additional agriculture

practices like honey bee keeping, production of eggs and vegetables were forced to discontinue due to problems faced by them in terms of selling their produce, not getting enough returns and insufficient support from the government.

After the discussions with the farmers in these districts, i can say that the development of agro- industries can open up wide possibilities for the diversification of the agricultural production pattern.

6.7 Labour Factor

As a result of rising demand for labour in agriculture, industry and trade sectors, there has been an influx of population in Punjab from other states of India. Apart from the fast growing developments in farming and non farming sectors in the economy of Punjab, rice cultivation is the main reason for attracting and absorbing the influx of migrant labour. The migration of labour has made labour supply more elastic, with the result the wage rates in Punjab in almost all the sectors have declined and thus lowered the cost of production; unfortunately, the local labour could not gain proportionately out of this process of economic growth as the migrant labour was ready to work at lower wages than the local labour which rendered the migrants more job opportunities than their local counterparts. Accompanied with the migrant labour there are certain socio- economic problems which have been created in the state. The objective of studying this aspect regarding the perceptions of local farmers towards migrant labour was to look at the general effects on society due to migrating labour which basically migrates for the purpose of rice cultivation in the state.



Picture showing migrant labour working in rice field

The migration in the state has lead to development of conflicting scenario among the local labour and the migrant labour. Indications from the fieldwork suggest that although most of the farmers employ migrant labour but most of the farmers were quite critical of their role. The general reason of employing migrant labour is the increasing trend of disengagement from agriculture by the Punjabi youth due to less attractive returns in the profession and their passion to migrate abroad. The various perceptions regarding migrant labour were recorded and are presented. 67 percent of the farmers blamed migrant labour for increasing use of drugs in the state. Besides this factor, farmers believed that thefts, murders, rapes and kidnappings have increased with the emergence of migrant labour.

In the district of Ludhiana, 47 percent of farmers blamed migrant labour for creation of slums, 55 percent for transmission of diseases and 58 percent blamed them for traffic hazards in the district.

While some of the above mentioned perceptions are important for environmental concerns around cities but mostly it shows the indirect effect of crop pattern (labour migrates in the state for cultivation of rice on large scale) on the social structure of the state.

What I interpret from the study is that no doubt that farmer blames the migrant labour from other states for their concerns but at the same time they are much dependant on these migrants due to non availability of local labour.

It is important to know as to why so much labour is required from outside the state for agricultural purposes. It is a common phenomenon in Punjab in recent years that Punjabi youth are not very comfortable with the agricultural work. Questions were included in questionnaire to probe about the labour factor in the state.

When asked about how many farmers employed migrant labour all year around. The answers revealed a certain pattern which relates this aspect to others.

Table (11)

District	% of Farmers who employ local labour	% of Farmers who employ migrant labour
Mansa	92	8
Ludhiana	3	97
Hosiarpur	25	75

Source: fieldwork, June-2004

From the above table, we can see the pattern that is almost opposite within the three districts. As mentioned earlier that there are no large scale factories in Hosiarpur and almost absence of factories in Mansa district as the result people were compelled to work in fields. As Ludhiana is the largest industrial city, most of the youth preferred to go to work in factories rather than in fields. With an average wage rate, it amounted to the same money which it will take to employ a labourer. So the reason behind not working in the fields was obvious as they linked it to their personal dignity to work in fields along with other migrant labour. City culture could also have been responsible for its impact on the rural changes.

When the farmers were asked about the factors which lead to their selection of labour for their fields, it was again a different pattern in the answers.

In Mansa district, farmers who employ migratory labour choose ('laziness' of local labour) as a primary reason for not employing local labour and also they felt encouraged by comparatively cheap migrant labour.

In Ludhiana district, 79 percent farmers said that they didn't employed local labour because they discontinued themselves (local labour themselves don't turn up for work), 18 percent farmers said (expensive) as the reason for not employing local labour and shortage of local labour as the reason for choosing migrant labour.

In Hosiarpur district 55 percent farmers were of the view that the local labour discontinued themselves and also the ability of migratory labour to work for more hours as the main reasons for employing migrant labour.

An interesting factor which came out in the group discussions was that majority of the local labour was voluntarily unemployed in the fields as they did not like to be employed as farm labour because of the dignity factor and preferred instead to move to nearby cities and work as industrial labours.

6.8 Land and Social constraints

The density of population in the state is 403 persons per km² (refer to url⁶ on page 110) which means high population pressure. As the dependence on agriculture is very high and the possibility of land expansion is negligible keeping in mind that already area under cultivation is reaching its limit, there is even more land constraint in the state leading to sub division of holdings and thus decreasing the average size of farm.

Rate of industrialization has been low and is not making perceptible dent in decreasing pressure of population depending, directly and indirectly on agriculture. Besides, land constraints, there are several social constraints which Punjab is facing now like the attitudinal changes among the farmers. During the survey 60 percent of the farmers said that individualism has increased among the farmers over last 10 years. This aspect becomes important because it is linked with the culture of working together in a family or with relatives. It appears that with the onset of globalization, farmers in Punjab have also become more concerned about their individual acts as farmers reported that the days were gone when family members used to work together in the fields and supported each other. Working together in coherence with the family saves a lot of money because some of the labour and domestic needs are met by the family members within themselves.

86 percent of the farmers said that the dependence on labour has increased substantially over last years even in non agricultural domestic settings. The domestic settings here include the labour work needed within the house like taking care of cattle, etc. This change is responsible for increasing the cost of living and therefore resulting in economic burden on the farmers. Over dependence on labour and the advent of status building within their community often leads to extra expenditure. The changes in lifestyle which demand a certain level of standard to be maintained in the society, irrespective of the income contributes to over spending. In majority of the cases, farmers either sell their land or go in for loans and eventually end up in the viscous circle of debts.

Other constraints-

In order to know about the farmers' perception about the constraints they meet in the agriculture profession, several elements both biotic and abiotic were listed and farmers were asked to express their level regarding these elements.

Among abiotic constraints, farmers expressed temperature, rainfall, marketing and water for irrigation as the high constraints in agriculture presently. Farmers were of the view that rising temperatures and untimely rainfall were among the high constraints for the crops. It should be noted that rainfall still plays an important part in agriculture of Punjab even though majority of the area is irrigated by either underground water and canal system because firstly it is responsible for replenishment of under ground water and secondly the time of rainfall is important as the rain which coincides with the transplanting of paddy crop can actually

substitute a lot of water which was otherwise to be supplied by tubewells. Marketing of their produce was also high on the constraint level among majority of farmers. Farmers who opted to diversify their crops with the addition of pulses, sunflower, and sugarcane were highly critical of the marketing system because they said that they had to face many difficulties while selling their produce. There was no central agency assigned for the purchase of these crops and the farmers had to wait as long as two years to get their reimbursement money in case of sugarcane from the government. Water for irrigation was also on the high constraints list particularly due to declining water level across these districts.

Transportation, storage, credit availability were expressed as moderate constraints. Transportation was particularly important in case of farmers from Hosiarpur district who grew some fruits and vegetables but due to lack of transportation facilities they could not be transported quickly enough to other demand areas which results in spoiling of these perishable produce. Storage can be divided into two categories, firstly there is a problem due to lack of cold storages in the three districts, due to which perishable products can't be stored for long time. With the help of cold storages these products can be made available for exports and also for internal use in the state for much longer time. The other category of storage is the normal selling place called 'mandi'. It is this place where farmers bring their produce and wait for government agencies to come and buy it from them. Often the problem is that these places are not well managed. They lack good roofs and enough space for farmers to lay their produce in the busy harvesting season, which leads to exposure of their produce to rain and adverse weather which as the result reduces the quality of the lying produce and hence affects the payment by the agencies.



Picture above shows farmers trying to drain water from mandi in order to protect the crop.

Credit availability was considered as the moderate constraint by the farmers. More or less government had launched many schemes recently like the kisan credit card which offers farmer easy and spontaneous loan agreements. Farmers in the selected districts seemed to be satisfied with the credit availability.

Seed quality, fertilizer quality, plant protection material were considered as low constraints by the surveyed farmers. Farmers were particularly satisfied with the seed quality. They also expressed negligible problems while getting plant protection material and also approved the quality of fertilizers according to their needs.

This part of the survey revealed that marketing and storage needs to be improved by government but farmers largely seemed to be satisfied with the seed research mainly done by Punjab agricultural university. The above mentioned constraints which include both biotic and abiotic elements effect the farmer's decision to go in for a particular type of crop pattern and these constraints are also responsible indirectly for contributing to agricultural stagnation as these elements discourage crop diversification.

Livestock is an important aspect of rural activities and play an important role in helping the agricultural economy. It was found that only 43 percent of the households had actually cows and 90 percent of the households have buffalo's. Only 17 percent of the households reported to be using the animals for dairy farming, which is quite low with respect to the possibilities in the state. Actually dairy farming can go a long way in contributing income to the household.

The economic and the social constraints discussed in this chapter often put Punjabi farmers in limelight regarding committing suicides. When farmers were asked about suicide perception, 65 percent of the farmers felt that economic reasons were to be blamed.

From the findings of the chapter, we can conclude that agriculture stagnation can not be seen as an independent term but it is a complex interrelationship between agricultural practices, ecological factors, societal behaviour and the government policy

6.9 Summary:-

Agricultural development plans of the state laid a greater stress on increasing agricultural production and achieving high growth rate. Due consideration has not been given to maintain the ecological balance. Wheat and rice pattern has dominated through out, partly because of constraints of resources and technical manpower, as the result other competitive crops lagged behind. The shift in production pattern towards dominantly monoculture of wheat – rice rotation supported by high yielding varieties, irrigation, market infrastructure and price support took place.

The wheat – rice rotation became more profitable and generally less risky compared to other crops. This change in production pattern though was mainly responsible for achieving stellar growth, but this pursuit of monoculture overtime, has resulted in manifestation of several adverse effects on environment and ecological balance, like the water level is dropping, soil is getting degraded, soil texture and structure has been adversely affected by puddling of land and rapid mechanization is polluting air and burning of paddy straw and wheat and paddy stubbles is becoming an increasing problem.

Actually all the constraints discussed in this chapter are largely the causes of agricultural stagnation in Punjab. This chapter also nullifies the common concept in the state that farmers are responsible for agricultural stagnation because this study establishes that farmers are ready for agricultural diversification but need an impetus push from the government through the launch of proper schemes with proper marketing facilities and storage capacities.

The next chapter deals with the role of the major institutions in Punjab namely the Punjab agricultural university and the department of agriculture, Punjab government.

Chapter seven

Role of Major Institutions

7.0 Introduction

Agricultural and extension education programs and institutions play an important role in determining the economic output of the agricultural sector and its development. These institutions run various extension programs which are directed toward meeting the needs of farmers and farming. Societal changes are opening new arenas for people oriented information and education. These institutions help people improve their lives through an educational process that uses scientific knowledge focused on issues and needs. In this part of the study I have tried to review the role of major agricultural organisations in the state namely the Punjab Agricultural University and the Department of Agriculture, Punjab government.

7.1 Punjab agricultural university

Punjab agricultural university (PAU) is the major university of agricultural research in Punjab. Established in 1962 in the central district of Ludhiana, the university has become an important centre of agricultural research and education in the state. The University covers an area of 1510 acres on its main campus and 4615 acres at the regional research stations making it possible for PAU to perform the integrated functions of teaching, research and extension in agriculture, agricultural engineering, veterinary and animal sciences, home science and allied disciplines (refer to url⁷ on page 110). The PAU has played a key role in increasing food grain production in the Punjab State several folds share its reputation and ushering in an era of Green Revolution in India.

The research wing of the University has been at the forefront of innovations in knowledge-based technology generation and its dissemination. It has played an important role in making the state of Punjab the wheat and rice bowl of the country. Increase in agricultural production and self sufficiency in food grain production in Punjab was made possible as a result of combination between generation and adoption of agricultural technologies. Research strategies in PAU have been reoriented from time to time. Earlier, the university spearheaded the Green Revolution in the region, fine tuning and disseminating technologies for increasing

agriculture production through management of the semi dwarf wheat's and rice's. The initial successes were followed up, with better and refined technologies, release of high yielding varieties like the wheat Post Green Revolution period, witnessed a progressive increase in intensification of agriculture which resulted in ever increasing constraints to increasing productivity.

The research and the production capabilities of the university have lead to building a bridge between farming and farmers of the state. Farmers not only form the receiving end of this bridge, adopting of new varieties and technologies but they also prove to be an asset by providing feedback to the research scientists, for further up gradation of technologies. Besides crop improvement and breeding , the major thrust areas of university includes:- crop management technology, water management , soil and nutrient management, weed management, post harvest management, disease management.

According to agricultural experts, PAU has been instrumental in developing appropriate engineering technologies / techniques for crop production, post - harvest operations, soil and water management and utilization of renewable energy sources for agriculture. These efforts have helped in making Punjab a front runner in agricultural mechanization. It also provides strong support for understanding and developing basic practices in agricultural and livestock. Agricultural university also plays an important role in forming various agricultural policies at state and national level by estimating the cost of cultivation of various crops which proves very useful in deciding minimum support price (MSP) for different crops.

The extension service of Punjab Agricultural University played vital role in ushering the green revolution in the state as this is the wing which actually interacts with the farmers. Directorate of Extension Education is responsible for running specialized training courses for the benefit of the farmers and development staff at the University Head quarter as well as at Krishi Vigyan Kendra (KVK's). These kvk's are extension offices of the university in other districts where farmers are given advice and other agricultural help. It also organises Workshops, Farmer's Fairs, three months young farmers training courses, Correspondence Courses for farmers and farm women. Krishi Vigyan Kendra's have been set in the Punjab state for imparting specialised training to the farmers by experts in the field of agriculture.

Presently there are scattered in 10 districts of the state but unfortunately none was situated in any of the three district covered under this study. This was infact one of the major reasons for

farmers in these districts particularly in case of Hosiarpur and Mansa where farmers tend to take advice from pesticide dealers as agricultural staff is not accessible in these districts due to lack of kvk's. This tendency was less prevalent in Ludhiana district where farmers had the access to PAU.

According to one of the university officials who were interviewed, Research endeavours of the university have been reoriented to generate technologies for increasing productivity, introducing resistance to abiotic and biotic stresses in crops, improving quality of the produce, increasing profitability and sustainability in agricultural production systems. Efficient use of inputs and conservation of natural resources, agro - ecosystem and improvement of quality of life in rural areas, are some of the current thrust areas.

Keeping with the present trends, PAU is currently developing cost effective technologies with emphasis on better relationship between crop productivity, profitability and sustainability of natural resources including soil, water, environment and other inputs are receiving greater focus. Research on export oriented production of wheat, rice and other crops, including horticultural, medicinal, aromatic and spice crops, for diversification of rice - wheat cropping system is also being intensified.

Developing integrated Soil Health and Nutrient Management Systems for sustainable crop productivity and efficient management of inputs, use of organic manures, green manures and bio – fertilizers also form important areas of present research. Studies for improving water use efficiency in different crops and cropping systems and suggesting timely crop management practices are being undertaken. The current research in farm mechanization include paddy production mechanization (Paddy transplanting and residue management), cotton production mechanization (Cotton planter, sprayer and pickers), and horticulture mechanization (Vegetable transplanters, weeders and sprayers).

The current research can go a long way in reducing the practice of paddy straw burning by providing better alternatives of its disposal to the farmers.

Upon contacting the water department of the university, it was learnt that technologies / techniques for recharging of ground water, remediation of sewerage water for irrigation, water balance studies and developing of suitable water harvesting technologies in sub- mountainous regions like Hosiarpur were receiving due emphasis in the department.

Efforts are on to develop machinery like crop dryers, gasifiers for industry, rice straw / husk based gasifiers, etc. Research on socio - economic aspects is focused on studying the economics and marketing of various crops, and impact of information technology on the socio economic status of Punjab farmers.

Besides, the ongoing research activities, university also arranges some interaction opportunities for farmers (kisan mela's), where farmers come in large numbers and are shown the latest crop varieties and farm machinery. Apart from the sale of seeds, technical guidance, question answer sessions, demonstration's of field crops, animals, feeds and their fodders are undertaken. These kisan mela's are generally held twice a year at the selected regional centres across the state.

From the above mentioned role played by the university, it can be said that the university has been playing a determinantal role in the farming scenario of the state since its establishment about 43 years ago and continues to play so by its research and extension services to the farming community.

Farmers' perception about Punjab agricultural university was on one the main issues in the course of this study. In order to accomplish this information, relevant questions were included in the questionnaire and also in the group discussions. As it is clear that the agricultural university holds an important place in the agriculture system of the state, so it was quite necessary to know farmers perception about this institute.

In the survey, it was found a mixed response to the question that how farmers did perceived the role of the university in the development of agriculture in the state. On compiling the answers, an interesting trend has emerged which shows that while majority of the farmers in the district of Ludhiana said that the university meant a lot for them as a support for their profession. They seemed to be highly satisfied with the services of the university. The appreciation came particularly for the kisan mela's which are organised by university to give knowledge about new varieties and technology. They added that they often participate in the farmer helping camps organised by the university. Majority of the farmers actually followed the instructions and suggestions given by the university. Generally they applauded the working of the university.

The farmers in the districts of Mansa and Hosiarpur had a different reaction the same question. In these districts, it was almost opposite reaction. Here majority of the farmers said that they don't perceive the university as any helpful institution for them. Farmers reported that they seldom visit the University for any Functions or seminars relating to agriculture. Even, surprisingly, many of the farmers had infact never been to university or one of its extension offices. They also replied in negative when asked that if any university official had ever visited their area.

The most probable reason for this divisive answer lies in the fact that there are no university extension offices or kvk in these two districts, whereas the university itself is situated in Ludhiana. The locational advantage to the farmers of Ludhiana is not available for the farmers of the other two districts. This trend of responses leads this chapter to conclude that even after more than 40 years of its establishment, the agricultural university has not been ale to reach all the corners of the state.

Another question which was included in the questionnaire was with whom farmers discussed their agricultural problems? The objective to include this question was to see that who was most influencing the farmers and their decisions as far as agriculture was concerned. Out of the farmers who responded positively to the question, about 18 percent actually discussed their agricultural problems with either university or kvk or any of the university representatives. The biggest share of advising was taken by the private pesticide dealers as 36 percent of the farmers replied that they approached these dealers for any kind of agricultural related advice. This result itself determines the level of impact the university has on the farmers of the state.

Upon contacting the university officials to take their view on the situation, they cited the lack of funds as the primary reason for not being able to establish at least one kvk in each district of the state. They also pleaded the lack of extension staff for the not reaching the farmers.

7.2 Department of Agriculture, Punjab Government

The Department of Agriculture and Cooperation is responsible for the formulation and implementation of National policies and programmes aimed at achieving rapid agricultural growth through optimum utilization of the country's land, water, soil and plant resources.

The Department is responsible for undertaking all measures to ensure timely and adequate supply of inputs and services such as fertilizers, seeds pesticides, and agricultural implements. It also provides agricultural credit, crops insurance and ensures remunerative returns to the farmer for his agricultural produce.

The Department is entrusted with the responsibility of collection and maintenance of a wide range of statistical and economic data relating to agriculture, required for development planning, organising agricultural census, assisting and advising the States in undertaking scarcity relief measures and in management of natural calamities e.g. flood, drought, cyclone, etc.

Matters relating to formulation of overall cooperative policy in the country, national cooperative organisations, cooperative training and education come under the preview of the Department. The Department also participates in activities of international organizations, for fostering bilateral cooperation in agricultural and allied sectors and for promotion of export in agricultural commodities.

The important part of the agricultural system in the government is the agricultural price policy, which aims at ensuring remunerative prices to the growers for their produce with a view to encourage higher production. Towards the end, minimum support prices for major agricultural products are announced each year which are fixed according to the production costs of the current year. Food Corporation of India (FCI) is the major procuring agency for the government. FCI is responsible for the procurement of all the crops grown by the framers but main emphasis is always on the procurement of rice and wheat. The reason may be their easy storage and demand for internal consumption and export outside the country.

Farmers' perception about the agricultural department is very important in order to understand the reasons behind the success or failure of government policies. When farmers were asked as to how did they perceived government's policy for agricultural development, there were a lot of answers covering wide aspects. But it was seen that big farmers were generally seem to be satisfied with the governments policies while small or medium farmers were often recorded complaining.

Major points on which the farmers critised the government policy on agriculture were ranging from that the government was providing less subsidies on fertilizers and pesticides, majority

of the farmers wanted the minimum support price of all crops to be increased. Many demanded that government should help poor farmers with inputs for agriculture. They advocated distribution of loans with zero percent interest for agriculture. Better fertilizers and more awareness camps were also among the requirements.

But above all these responses, one answer which was most common was the requirement of better marketing facilities. Most of the farmers seemed to be unhappy with the government's effort of marketing. Farmers complained that it was extremely difficult for them to sell the crops other than rice and wheat. It was seen that the farmers who tried to diversify to other crops were more depressed because they could not sell their produce, so as the result they had to again return to their usual cropping cycle of wheat and rice.

Many farmers unfolded their stories when they had to wait for weeks in order to sell their produce and often even months to clear their payment dues. All these factors discouraged them to switch over to other crops than traditional relatively easier to sell crops. Lack of infrastructure was also one of the main points which constituted the lack of well maintained mandis (selling places). Especially in the district of Hosiarpur, farmers complained about the lack of storage facilities in the district which prevented them for growing fruits and vegetables. Generally farmers were not satisfied with the government's agricultural policy as they felt that the policy doesn't hold anything substantial for them in their future.

Interaction with the agricultural department's staff can be analysed from the fact that only 13 percent of the farmers discussed their agricultural related problems with them. Even more serious were the results when only 2 percent of the farmers contacted animal husbandry department to meet their livestock requirements. The positive figures for the government were gathered, when farmers were asked about their membership any of the organisation at the village level, 51 percent of the farmers were found to be attached with co-operative organizations. These co- operative organizations are formed to work at the ground level. They are indulged in milk collection from the villages and sometimes, other products like honey also. Although with minor success, largely, it can be said that mostly farmers felt isolated from the government's policy on agriculture and wanted major changes in order to address their problems.

7.3 Summary

It's beyond doubt that Punjab agricultural university has played an important role in the development of agriculture in the state. It is responsible for creating awareness and dissemination of technology both genetic and physical. However, during the course of the fieldwork, it was found out that despite the claims of the university, the truth remains that even after 40 years of its establishment; PAU has not been able to reach the farmers , particularly in the districts where there are still no kvk's. Farmers prefer to approach private pesticide dealers in order to get their problems addressed. None different was the farmers attitude towards the agricultural policy of the government. But with the help of this chapter, an important link has been formed between the lacks of participation in diversification and the farmers approach towards diversification. This chapter has been able to falsify the claim of the government that farmers were responsible for not diversifying agriculture because what this study found is that farmers are often ready for diversification and infact many had even given it a try but the problem of marketing their produce had discouraged them to give it a second thought. The co operative organizations were found to be working exceptionally well in these districts. This chapter forms an integral part of the study by analysing the integration between agricultural institutions and the farmers. The next and the last chapter of the study deals with summing up of all the results and conclusion with recommendations.

Chapter Eight

Summary and Conclusion

8.0 Introduction

After the spectacular growth rate during the sixties and the seventies, the Punjab economy began to slow down in the late 1980s and decelerated further during the 1990s. Its per capita income grew at an annual average rate of 2.1 percent during the 1990s- significantly below the national average and the third lowest rate among major Indian states (Punjab development report, 2004). The main issue concerned in this study concerned causes and effects related to the stagnation of agriculture. The study takes its departure from the fact that there is growing evidence of agricultural stagnation, attributable to government policies and specific land use activities of the local framers. However there is strong emergence that the prevalence of certain government policies has led to a time where present day Punjab stands in crossroads.

The main objective of the study was to explore the presence of stagnation and further look at the basic reasons leading to the problem and the possible fallouts both ecological and social. The research approach adopted has examined the present land use patterns in the study area and assessed their problems, conflicts and challenges in the land use system in the three districts of Punjab state. Changing scenario of Punjab agriculture discuss the pre and the post green revolution era with special emphasis on ecological and social changes and the relation between these perspectives and the issue of stagnation. The final chapter summarises the issues raised and the major findings of the study. However it will include the major emphasis on future perspectives and recommendations as this part responds to one of the objectives of the study conducted.

However before summarising the findings and giving recommendations, a few comments on the sensitive issue of stagnation in the state.

The notion of stagnation in agriculture in the context of Punjab state, as indicated in the beginning of the study, is not clearly fixed. The definition of the stagnation in this study can depend upon the attitudes and aspirations of the society particularly farmers, its perceptions and knowledge of environment and the assemblages of organisational skills. The application of principles of agricultural management is a growing aspect in modern farming. The notion of management, of using various techniques to reach defined objectives, is quite relevant for

agricultural sector because in a state like Punjab majority of people depend upon agriculture and thus relating to nature. Resource management in agriculture should be applied to decisions involving natural resources. It is closely associated, for example with resources like water, which may be common property component of the environment. Similarly, the whole agricultural environment can be viewed as a complex interacting system of many resources and activities that's individual and combined functioning must be first understood before problems and opportunities can be identified and desirable realistic objectives set.

It is proper that priority attention is given to agriculture in terms of resource management. According to Punjab development report by world bank , the likely land use pattern in the coming years suggest that an agricultural use of same kind will continue to be pre dominant in the state. This means that majority of land use pattern in agriculture will continue with the current practices. This will lead to implications for lands under forest cover, for biodiversity and environmental degradation in general. Environmental degradation particularly leading to lowering of ground water table and depressing farming community are the reasons that this study focuses on stagnation and agriculture systems of farmer's interaction with their environment.

8.1 Summary

Findings and discussions of this study have indicated that considerable attention has not been paid to understand the inter relationship of human activity and natural resource use in Punjab. Much of the debate has been concerned implicitly or explicitly, with resource overuse and misuse. The present study portrays society - nature relationship in terms of stagnation in agriculture. During the course of the study it was identified that actually environmental degradation is due to the lack of synchrony between practices of the farmers and the role of institutions in the state.

The study has also identified that increasing the level of knowledge and potential among the farmers of the state can go a long way in effective interaction and harmony with nature. Farmers have been shown to be aware of problems to some extent but they express their inability to change the order of the things without the external support of the institutions due to the complex scenario of policies with regard to procurement and pricing of the crops.

Majority of the farmers had expressed their view in negative when enquired about the profitability in agriculture but this study leads to the conclusion that the situation is complex and there is no one factor to be blamed for stagnation. This study finds a sense of insecurity among the poor farmers regarding the future of agriculture.

This study concludes that there is declining in prosperity in agriculture in spite of increase in prices of agricultural products, the input prices are also going up with almost same pace. The crop productivity, on the other hand has stabilised resulting in slower increase in monetary returns. The cost of living is also increasing because of the fast increase in general price index and as the effect of globalization, the priorities have also changed which often leads to more expensive lifestyle. In order to keep pace with the consumption trends in society, the farmers have to spend beyond their capacity for which they either to go into dept or to dispose of their assets, particularly land. As a consequence of decline in profitability in agriculture, the rental value of land has gone down causing further decline in income.

The conclusion can be summed up in a flowchart showing all the major factors of agricultural stagnation and their relation to each other. On the base of the flowchart we start with three major actors involved in this research Farmers, Punjab Agricultural University and the Government. The role of the government is characterised by poor management which has constituents of lack of marketing for sugarcane, cotton etc and poor storage facilities for perishable crops and fruits. Another character of government is lack of proper policy, which is mainly faulty due to lack of any thrust for agricultural diversification, lack of incentives, attractive procurement arrangements. Both poor management and lack of proper policy lead to continuance of wheat and rice cultivation in the state which leads to adverse effects on the health of environment in Punjab as discussed in the study.

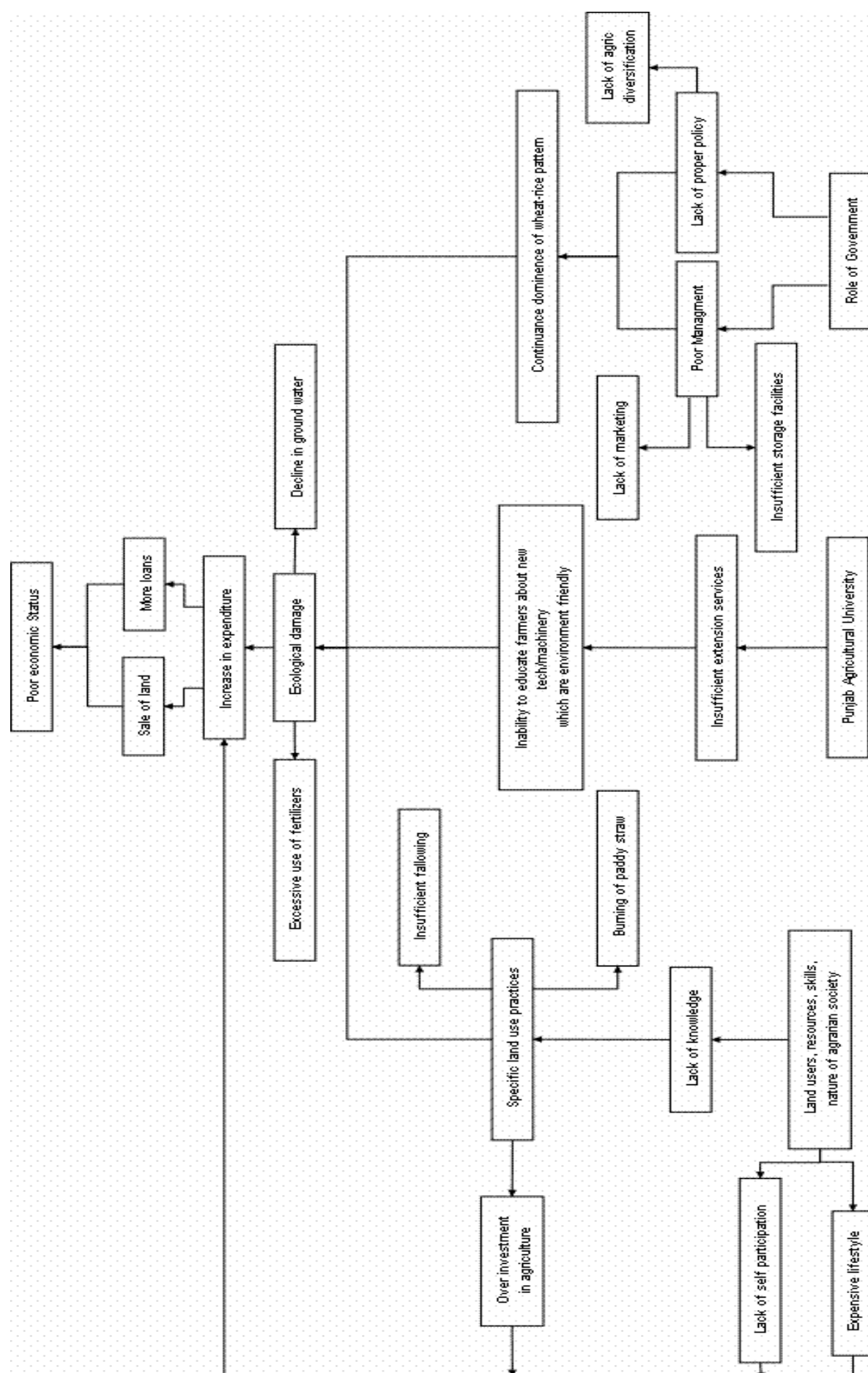
Punjab agricultural university's role has been analysed and this study has found that there is clear gap between its presence and farmers. It has not been able to reach at the grass root levels through its extension services which lead to farmers being unaware of new ecologically efficient mechanisms in agriculture. The absence of university officials or agriculture centres in selected places does not allow the dissemination of knowledge. It is often that the development of knowledge is contained within the departments. This unawareness leads to pursuing of methods which are responsible for ecological damage.

The third actor in the study is found to be farmers whose skills; resources influence the pattern of agriculture. It was found that inadequate lack of knowledge among farmers for agricultural practices lead to specific land use practices. These practices include intense cropping leaving little or no room for land to rejuvenate. The practice is of burning of paddy straw is another result of faulty land use practices. These specific lands use practices when added to the shortcomings of the university and the dominance of wheat-rice pattern in agriculture adversely effects the environment which includes decline in groundwater table and excessive use of fertilizers.

Once the ecological damage like the decline in water table are done, then it requires large sums of money to upgrade the tube wells and the boring machines, in order to extract the water gain from the ground which goes below each year. So the ecological damage leads to increase in general operations of agriculture. Other factors which add to increase in general expenditure includes the major characteristic of specific land use practice i.e. the over investment in agriculture in forms of tractors and other implements which are often bought and as the result a lot of investment is made which could had been avoided by renting that machinery, this tendency specially implies to farmers who belong to low and middle farmer groups. Other behavioural factors like tendency to maintain high lifestyle and overdependence on labour also lead to increase in general expenditure in the families. When the expenditure due to above said practices exceeds the income of the farmer, he often goes either to borrow loans or to sell some part of his property (land, in this case).

Often selling of land or getting loans lead them to a trap or a vicious circle from where it becomes extremely difficult to come out. Once they are poor, they sell more land or opt for another loan to repay the earlier one and so on. Once the situation becomes uncontrollable, farmers even go in for suicides. So, this is how this research study has been able to link the different factors in agriculture, which leads to stagnation of economy and agriculture as well.

Based on the explanation above, a flowchart below tries to explain the chain of stagnation in agriculture with the role of concerned factors at different stages.



8.2 Implications for Policy Making and Implementation

The urgency to reform and the hectic pace of policy making, unfortunately, appears to be fading away. The primary cause of reform slowdown appears to be political. This section deals with the agricultural strategy and planning.

As discussed earlier that the agricultural development with focus on agricultural production has lead to ignoring of ecological balance and social scene in the state. To deal with the current situation , an agricultural strategy to concentrate on important areas for research to alleviate or eliminate these adverse effects for attaining sustainable development are identified as below.

- Development of sound land use system based on soil capabilities
- Water budgeting in relation to planting period, soil type and water availability.
- Development of management practices for use of marginal and poor quality irrigation water on long term basis.
- Long term impact of wheat – rice system on physical, chemical and biological properties of the soil.
- Monitoring excessive use of agrochemicals in relation to ecology and economy.
- Integrated pest management systems for minimising pesticide problems.
- Preservation of agro biodiversity, including an appropriate legislation.

It seems that the prolonged dominant monoculture of wheat- rice rotation has now resulted in deceleration of agricultural growth as well as productivity per ha. Fatigue in technology may be another reason for this phenomenon as no major break through in the improvement of rice and wheat varieties has occurred since the green revolution. It is worrisome and the necessity for diversification for production pattern has time and again been emphasized for the decade or so.

Development of high value products, namely fruits, vegetables, horticulture and floriculture offer good opportunities but adequate agro - processing facilities , marketing structure and other infrastructure are required to be build up to render them successful.

In brief, at present a strong political will, proper guidance by agricultural institutions and equally remunerative alternatives should be made available to substitute area under wheat and rice in the state.

8.3 Future Perspectives :-

With the implementation of WTO agreement, there are good prospects of export for wheat and rice from developing countries which can generate surpluses and their prices are likely to increase in the international market. In future , thus Punjab has good prospects for exports, for wheat and rice but at the same time, the monoculture is creating a difficult ecological imbalance and underground water shortages—it seem as an paradox.

A three – prolonged strategy may be required to deal with the ecological and other problems created by monoculture of wheat and rice rotation:-

- Searching solutions within the prevalent production pattern, e.g., reducing water requirement of rice by avoiding early sowing and decreasing the use of standing water replaced by wetting, recharging the ground water, more judicious use of insectides and weedicides, expanding the integrated pest management practices, promoting balanced use of fertilizers, etc. is essential to find adequate solutions.
- Evolving equally or more remunerative alternatives to wheat- rice rotation. It may be done by putting emphasis on bio technology research for evolving improved varieties of crops which offer good substitutes;
- A medium and long term development plan taking into account the potentialities of modern technologies should be formulated covering relevant aspects of ecological agriculture towards sustainable development, which conserves water, plant and genetic resources; is environmentally non degrading, technically appropriate, economically viable and socially acceptable. Such a plan should also include appropriate policies, programmes and projects to implement it.

8.4 Salient Recommendations:-

The Punjab agriculture is at the crossroads and if the remedial steps are not taken it may lead to serious outcomes. This part of the study will deal with some of the measures which can go a long way in easing the situation in the state.

The salient recommendations of this study are:-

- There are viable options to improve factor productivity in agriculture which requires massive public support and infrastructure. There is considerable scope to harness the potential by diversifying to dairy, vegetables, fruits, fishery and subsidiary enterprises like poultry, mushroom production, bee keeping etc. This requires massive public support for building up matching infrastructure for marketing and continuous farmer training for adoption of new ventures, establishment of dairy units and government support for animal health.
- There is also an urgent need to reduce pressure on land through industrialization. An intensive survey of rural industrialization development which could create substantial job opportunities every year in rural areas coupled with appropriate steps for developing relevant skills through vocational training should be taken up. Functional townships in selected rural areas need to be established, where all modern facilities of roads, water, power, telecommunication, health, education etc are made available. The industry in rural areas should be provided incentives by way of tax exemptions.
- Investment in agro- processing, storage, market information, market development, rural roads, etc, needs to be stepped up in a big way.
- The potential pockets for specialization in high value enterprises should be identified, and in the selected areas the matching technical guidance for entrepreneurial development, the specific infrastructure support and the related market development should be developed as an integrated system.
- The agricultural credit delivery system, extension advisory system and quality input delivery system (especially for small and marginal farmers) should be strengthened.
- To meet the challenges and to harness the emerging opportunities, the agricultural research system should be adequately funded.

Sustainability of current strategy is doubtful, so future strategy should include:-

Achieving higher productivity of crops, soils and livestock

Identifying efforts to alleviate problems associated with rice – wheat system

Providing knowledge about optimize use of fertilizers, agrochemicals, irrigation water and other inputs.

Requirements for implementation of future programmes:-

As the above mentioned diversification activities are highly capital intensive and risky enterprises, arrangements for adequate, liberal and timely credit facilities have to made especially for small and medium farmers.

Infrastructural and institutional support is crucial because, the major problem of these perishables has to be overcome by enhancing the shelf life and prolonging the marketing period of these crops and absorbing the market gluts through market stabilizing programmes.

The proposed diversification options require modern infrastructure and market support through public and private investment in terms of facilities like credit, efficient chains from producer to consumers including long distance refrigerated transport, value addition by processing and proper marketing of these commodities in target markets. Technical support and training facilities for these enterprises which require high degree of skill and knowledge are presently inadequate and require adjustments to suit the requirements of diversification options.

Roads and transport needs to be satisfactory in order for the movement of food grains produced. However, due to the perishable nature of fruits and vegetables, it is important to develop better roads for the rapid movement of farm produce. Facilities for refrigerated transport which are essential for the proposed ventures need to be drastically modernized

The present marketing infrastructure and institutional arrangement in terms of stabilized prices and assured markets are quite effective for wheat and rice crops. The marketing network for fruits and vegetables is grossly inadequate. The prices of these commodities are volatile and the assured marketing is lacking. Assured marketing and appropriate pricing are most critical support systems for the success of the proposed ventures.

Storage facilities are basically designed for storing wheat and rice whereas for fruits and vegetables we need multi- purpose storage systems well equipped with cooling facilities. Thus major effort is required from government sector and private sector to provide this critical infrastructure. This may also help in stabilizing the prices of these perishables commodities.

Large scale agro – processing facilities in the organised sector are non existent. Presently these perishables are produced primarily for the table purposes and lack the required quality

parameters for their processing and preservation. Two essential pre – requites for promoting these ventures are:

- Development of varieties suitable for processing
- Assured bulk supplies of these commodities

This will necessitate attaining high yields at lower costs and meeting the quality standards in the markets.

Besides the above said recommendations, below are some of the steps which can also help to ease the situation.

- It has been found that rice planted in June leads to saving of 25 – 35 percent in water over May planting (Narang and Gulati, 1995). Therefore, a vigorous water management education programme should be launched to educate the farmers of harmful impact of early planting of rice and if needed special legislative measures may also be taken to regulate the planting of rice in the state.

- It has been estimated that about 60 percent of irrigation water is lost in form of seepage losses (Sondhi and Khepar, 1995). Therefore, lining of canals, water courses, and field canals, use of underground pipe line for conveyance of irrigation water and adaptation of modern means of irrigation such as sprinkler irrigation and drip irrigation should be practiced. There is thus an urgent need to educate the farmers, planners, administrators and above all politicians to bring awareness of the current status of the use of this primary natural resource and to develop conservative water use culture and to bring in conscious mass awakening for abandoning counter productive wasteful water use practices in some cases like early planting of paddy during high evaporation summer months, overdrawng of tube well waters.

- There is an urgent need to make proper use of huge biomass which is burnt as such. Rice husk and other crop residues can be processed in proper form rather than transforming them into gases which are harmful for human, plant and animal health. Burning in the field is also harmful for the soil microbial activity. The abundant availability of crop residues, potential forestry and grasses in the semi – hilly tracts can be used to produce card board, paper and plywood.

- To be successful, however , attention will have to be paid to a number of aspects of contract farming, e.g., selection of crops, development of quick and efficient contract enforcement and dispute resolution system and developing framers ‘s organisations capable of contracting with sponsors, with a view to reducing transaction costs, increasing information flow and improving farmer’s negotiating position.

Until reform is put on the top of the political agenda by all parties – with the support of key elements of civil society- the situation in Punjab is likely to continue its downward spiral.

8.5 Concluding Remarks:-

The economic, social and ecological changes that manifests themselves with the framing community of Punjab, whether caused by ‘particular land practices’ or by approaches and policies promoted by the state and its institutions, are crucial for both farmers and nature and the effects are clearly noticeable in terms of stagnation in all forms. The alternative management for the prevalent crises should be an outcome of ideological trends, reflecting the needs and aspirations of farmers in whose interests; programmes can be implemented so that their effective participation can be secured. These involve increased reorganisation of resource management practices, analysis of the value of such practices under current and future conditions, assessment of the ways to adopt sustainable practices and modern agricultural planning approaches. Empowering farmers, groups and communities to take greater responsibility for the long term management of their resources and securing a better and promising future. The issues taken up in the study serve to direct attention to a number of important causes leading to stagnation in agriculture and provide possibilities for sustainable agriculture management in this northern Indian state of Punjab. It is the conviction of this study that positive potentials of the farmers can be harnessed for sustainable growth in economic, social and ecological sectors of agriculture community.

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Appendix I

1 Agricultural change in Ludhiana:-

	1960-1	1968-9
Percentage of land irrigated	45	70
Fertilizer application(kg/ha)	19.7	271.3
Area under HYV(ha)	68.8	169,971.7*
Yields (kg/ha)	1,552.3	3,676.3

* ninety percent of the wheat area

Source: Frankel (1971).

2 Household Survey Results:-

Household material	Presently possessing	Possessed 10 years ago
Car/jeep	33%	4%
Two wheeler	75%	36%
Refrigerator	86%	32%
Washing machine	30%	4%
Television	84%	33%
Cooler	39%	6%
Video cassette recorder	11%	1%
Generator	21%	1%
Cooking gas	83%	16%
Sofa set	34%	16%
Telephone, landline	37%	10%
Mobile	33%	nil

The above table shows that, there have been considerable changes in the economic lifestyle of the farmers.

Appendix II

Sample questionnaire and interview guide

Questionnaire for farmers

Farmers and farming: Punjab at crossroads

An attempt to understand trends of agriculture in the northern Indian state of Punjab.

The primary purpose of this questionnaire is to examine the causes of agricultural stagnation. It is also an attempt to examine the socio-economic characteristics of the farmers with regard to agriculture in the state of Punjab. The study is an academic exercise but the findings could contribute to policy recommendations regarding agriculture. Responses provided will be used only for academic purposes.

Part I

1. Name _____ 2. Father's name _____

3. Village _____ 4. Block _____

5. District _____

Family: Joint _____ Nuclear _____

If Nuclear since when _____ (years)

6. Family Status :

Relationship with respondent	If residing with family	Age	Sex	Education i) Formal/ ii) Training/ iii) Others	Occupation		Income Monthly(Rs)	
	If not specify				Primary	Secondary	Primary	Secondary
Self								
Permanent Worker								

7. a) Land details (acres) :

Land particulars	Irrigated		Unirrigated
	Tubewell	Canal	
i) Owned_____			
ii) Leased in_____			
iii) Leased out_____			
iv) Operational land holding_____			

b) Land ownership detail :

Particulars (acres)	Irrigated	Unirrigated
i) Inherited land		
ii) Purchased at your level		
iii) Sold at your level		

8. a) The reason for specific land transaction :

Purchased	Sold
i) More income	i) Less income
ii) Easy loan	ii) indebtedness
iii) Land attachment	iii) Non farm investments
iv) Any other (specify)	iv) Social obligation
	v) Any other (specify)

b) Annual transfer of investment :

Particulars	Rupees
i) From farming to non farming	
ii) From Non farming to farming	
iii) Net transfer	

9. Livestock inventory :

Particular	Number		Value		AverageYield
	Presently	10 years back	Presently	10 years back	
a) Cows					
b) Buffalo					
c) Bullocks/Camel					
d) Poultry birds					
e) Goat/Sheeps					
f) Fishery					

How do you dispose the waste of livestock? (Please ✓)

- (a) Burning ()
 (b) As FYM ()
 (c) Use in Gobar Gas Plant ()

10. Farm Machinery/Implements :

Particular	Number		Value	
	Presently	10 years back	Presently	10 years back
a) Tractor				
b) Trolley				
c) Combine				
d) Thresher				
e) Harvester				
f) Seed-cum Fertilizer drill				
g) Electric motor				
h) Diesel engine				
i) Cultivator				
k) Paddy transplanter				
l) Any other (specify)				

11. Housing :

Particulars	Pucca/ Kaccha/ mixed	Number		Value	
		Presently	10 years back	Presently	10 years back
Rooms					
Modern toilets					
Old toilets					

12. House hold material possession:

Particular	Number		Current Value (Rs).
	Presently	10 years back	
a) Car/Jeep			
b) Scooter/motor cycle			
c) Refrigerator			
d) Washing machine			
e) T.V. (Colour/BW)			
f) Computer			

g) Stereo system			
h) A.C			
i) Cooler			
j) VCD/VCR			
k) Elect. Fan.			
l) Generator			
m) Inverter			
n) Cooking gas			
o) Gobar gas			
p) Sofa set			
q) Dinning table			
r) Any other (specify)			

13. Awareness of health and Hygiene :

Particulars	Change over last ten years		
	High	Moderate	Low
General Health			
Food & Nutrition			
Importance of hygienic living			
Children diseases & cure			
Vaccination schedule			
Community health			
Any other (specify)			

14. Mass Media Exposure and its impact:

Particulars	Exposure over last 10 years			Specify Impact
	High	Moderate	Low	
a) T.V				
b) Cinema				
c) Radio				
d) Newspaper				
f) Any other				

15. Social cohesion: Over Ten years.

Relationship of family member with:

	Improved	Not affected	Decreased
i) Neighbours			
ii) Relative			
iii) Friends			
iv) Among family members			
v) Among the people of other caste			
vi) Among the same occupational group			
vii) With other occupational group.			

16.General perception about local/migratory labour :

a). Reasons for not employing local labour (Please ✓)

- a) Discontinued himself
- b) Expensive
- c) Lazy/work shirker
- d) Obtain advance from other farmers
- e) Dishonest
- f) Unskilled
- g) High perks
- h) Any other, specify_____
- i)

b). Reasons for employing migratory labour. (Please ✓)

- a) Comparatively cheap
- b) Can have longer working hours
- c) More submissive
- d) Shortage of local labour
- e) Any other, specify_____
- f)

17. Give perception regarding migrant labour & criminality:

Particulars	Increase	Decrease
a) Use of drugs		
b) Theft		
c) Dacoits		
d) Murder		
e) Rape		
f) Kidnapping		
g) Creating slums		
h) Transmission of diseases		
i) Traffic hazards		

18. Give perception about suicide commitment by farmer's (Please ✓)

- a) Economic ()
- b) Social ()
- c) Personal ()

19. Attitudinal changes among farming community:

Particulars	More	Less
1) Egoism		
2) Selfishness		
3) Dependence on labour		
4) Luxuriant life		
5) Competition		
6) Social cohesion Within family Out of family		

20. Compare the effect of time on agriculture and life from 10 years ago:

.....

.....

Part II

1. Crops grown:

Particulars	Area in acres		Yield	
	Present	10 years back	Present	10 years back
Kharif Crops				
a) Paddy				
b) Cotton				
c) Sugarcane				
d) Any other				
Rabi Crops				
a) Wheat				
b) Sunflower				
c) Any other				
Vegetable crops				
Horticultural crops				
Floricultural crops				

2. Specify the reasons for growing above stated crops by ranking them.

- i) Easy to grow ()
- ii) Due to their more demand ()
- iii) Assured price ()
- iv) Better return ()
- v) Any other (specify) ()

3. Biotic and Abiotic constraints experienced presently:

I Biotic	High	Moderate	Low	Nil	Suggestions
a) Disease					
b) Insect/Pest					
c) Weeds					
d) Rats					
e) Any other specify					
II Abiotic					
a) Temperature					
b) Rainfall					
c) Humidity					
d) Marketing					
e) Transportation					
f) Storage					
g) Input availability					
i) Better quality seed					

ii) Quality fertilizer					
iii) Quality plant protection material					
h) Labour					
i) Machinery					
j) Credit availability					
k) Water for irrigation					

Q4. Rank the impact of changes in crop system on soil health

- i) High doses of fertilizers ()
- ii) Deficiency of micro-nutrients (zinc Fe, Mn) ()
- iii) Soil Structure ()
- iv) Water lodging ()
- v) Any other_____

Q 5. Rank the following according to their seriousness regarding health hazards related to crop system:

- i) Respiratory problem ()
- ii) Skin problem ()
- iii) Air pollution due to burning of paddy/wheat straw ()
- iv) Water pollution ()
- v)Any other_____

Q6. Do you burn the paddy straw?

Yes () No ()

If yes why_____

If no, used for which purpose: Plough up/Factory disposal/Cattle feed/others

Suggestion for appropriate use._____

Q7. Have you been the member of the following Village/Block organization? (Please ✓)

- a) Panchayat
- b) Cooperative organization
- c) Social Committee
- d) Religious Committee
- e) Farm organization
- f) Panchayat Samiti
- g)

Impact on farming_____

Q8. Do you discuss any of your agricultural problems with other people?

Yes ()No ()

If yes, Specify with whom,

- a) State Department of Agriculture ()
- b) State Deptt. of Horticulture()
- c) Agricultural University/ KVK ()

- d) Animal Husbandry()
- e) NGO ()
- f) Private agencies (paid) ()
- g) Pesticide dealers ()
- h) Others (), specify_____
- i)

Q9. How do you perceive the role of Punjab Agricultural University regarding agricultural development?

.....

.....

Q10. What is your viewpoint about agriculture in present time with regards to profitability and growth?

.....

Q11. In which ways do you think farmers can help themselves?

.....

.....

Q12. What are your perceptions about government's policy for agriculture development?

.....

.....

Q 13 (a) Are you aware about diversification: Yes () No ()

If yes

a) Did the government make any efforts about diversification?

.....

b) Are you in favour of diversification? Give reasons

.....

c) What are your suggestions about diversification?

.....

.....

Q14. Do you want your coming generation to be engaged in agriculture?

Yes () No ()

(Support your answer with reasons)

.....

Q.15 Credit Status

Particulars	Amount	Purpose	Rate of interest	Amount repaid	Out standing	Specific problems
I. <u>Institutional</u>						
a Commercial bank						
b Cooperative societies						
c Regional Rural bank						
d Land Development bank						
e Any other specify						
II. <u>Non Institutional</u>						
a Commission Agent						
b Money lender						
c Friends						
d Relatives						

Subsidy status:

Do you get any direct subsidy Yes () No ()

If yes, specify the programme and amount

.....

Thank You

For Punjab university officials and for department of agriculture, Punjab government.

The following topics were discussed at the institutional level.

A) For PAU officials-

- Role of the university in helping the farmers
- Response to agricultural problems
- Functioning of extension department
- New technology production
- Future ambitions
- Efforts for agricultural diversification
- Present problems faced by the university

B) For Agricultural Department in Government of Punjab-

- Discussions about the efficiency of agricultural policy
- Infrastructure setup for agricultural operations
- New packages for diversification
- Credit facilities
- Solutions for the Problems in agriculture
- Step being taken to prevent further ecological damage
- Problems faced by the government in implementing new schemes.

