CHAPTER- 7

AGRICULTURAL DEVELOPMENT AND RECOMMENDATIONS FOR FUTURE

The urgent challenge before us is to maintain production of food, fiber and fuel for rapidly growing population, at the same time, arrest the declining productivity of soils, dwindling resources of water, deteriorating environment and coping with climate change. The major problem of the region is low yield, low technology, poor infrastructure, high levels of post harvest losses, heavy dependence on land for livelihood. In case of upper Ganga Yamuna Doab region, the Net sown area under crops is decreasing and the population is increasing at a very fast rate. The fertile land is largely being used for non-agricultural purposes. The net sown area of the region in the year 1984-85 was 1554194 hec. (78.4%), which has been reduced to 1490301 hec. (76.1%), net reduction of 63893 hec. of area in a span of 20 years. Which is 2.3% less of the total area sown in the year 1984-85. Production of oil seeds, food grains, sugarcane have also increased manifold over the period but rapidly growing population of the region levels the same. 70% of the holdings are below 01 hec. Average land holding size has been declining. The inability to reduce the dependence of the work force on agriculture, significantly by creating enough non-form opportunities to absorb labour surplus in rural areas and equiping those in agriculture to access such opportunities, has been a glaring failure of the development process in the upper Ganga Yamuna Doab as well as in India. With migration of the young men, the huge existing workforce in agriculture is aging and getting increasingly feminized.

Agricultural performance over a large part of the region is characterised with marked productivity variations. These variations in productivity are influenced by the physical & socio-economic factors. In the upper doab region, there is a variation in respect of soil fertility. The size of land holdings is also responsible for decision making of farmers. There is preponderance of small and semi-medium holdings and fields are highly fragmented which show low yields in farming areas. Application of new agricultural technology brought with high yielding varieties will be of great help. The intensive efforts should be made to evolve new high- yielding varieties. which suited to the agro-climatic zone. The factors which are responsible for the present
agricultural-Portfolio. There are small fragmented holdings, lack of proper-circles, semi-commercialized farming, poor investment, predominance of small farmers, unequal distribution of land, low level of productivity, conservation of farms, lack of finance and marketing facilities, lack of agriculture-inputs, poor technique of production.

**Recent trends and Concerns in Upper Ganga-Yamuna Doab region:**

The region's agriculture faced a number of threats in the last two decades relating to food security, farmers income & poverty

- Slow down in growth.
- Widening economic disparities between irrigated & rain-fed areas.
  - Uneven & slow development of technology.
- Inefficient use of available technology and inputs.
  - Lack of adequate incentives and appropriate institutions.
- Degradation of nature resources base. Rapid & widespread decline in ground water table, with particularly adverse impact on small & marginal farmers.
  - Increased non-agricultural demand for land and water as a result of the higher overall GDP growth & urbanization.
- Decline of public investment in agriculture form 4% of agriculture GDP to 2%, while subsidies increased form 3% (1976-80) to 7% (2001-03). Most of the subsidies are on fertilizers, power and irrigation water.

It is clearly recognized that availability of land & water is fixed. Growth in agriculture can be achieved only by increasing productivity per unit of these scarce natural resources through effective use of improved technology. The research system has to focus on efficient and sustainable use of soil nutrients and water. Identify location specific farming system with proper mix of crops and livestock for different areas. We have to identify region specific factors causing low productivity, like soil erosion, degradation, low seeds replacement rates, poor infrastructure, poor delivery of inputs, ground water depletion, moisture stress, drought & other factors. Each problem has to be tackled specifically. There is a need to form groups of farmers and
build their capacity to do better farming is considered a priority for transferring technology as well as building access to inputs & markets. Research to be focused mainly on increasing the yield potential by more intense use of water and biochemical inputs. Public and private investment in the agricultural sector need to increase manifold. Improved land and water management programmes and sustainable farming practices have to be adopted without exception for enhancing agricultural productivity. Poverty reduction and food security can emerge only from a thriving agricultural supported by improved productivity that can stimulate economic growth.

A large majority of the poor people living in the region depend on agricultural as a source of food and income. Many of the developing countries, including India have neglected. The agricultural sector, giving priority instead to industrialization. The farm gate prices offered to the farmers are low, the urban consumers benefit from low consumer prices. The inputs subsidies disbursed in the agricultural sector are skewed and benefit only a minority of large scale farmers who have access to irrigation facilities and are in possession of large tracts of high quality land. The import substitution policies protect local industries, the prices of goods that farmers consume are higher than world prices.

Agriculture being a state subject, India lacks an agricultural policy at the national level and the onus of framing policies for agricultural development lies with the state government. Even after five decade of independence, India has not been able to come out with a comprehensive agricultural policy nor has there been any worthwhile debate on the role of agricultural in the process of economic development. The earlier school of thought, that growth and advances in the industrial & service sector would transitorily benefit the agricultural sector on the whole, has always casts agricultural development in the shadows of industrial growth. Industrial growth in India has always been given precedence over agricultural growth and the emphasis and favors bestowed on it have continued even beyond the stage of infancy. Industrial sector so far has been receiving a major portion of the incentives and subsidies, at the cost and neglect of me agricultural sector. It has led to an constant decline in the share of agriculture in India's GDP since independence, with no decrease in proportion of employment provided by this sector.
Agricultural sector is too vital for India's economy to be put on the back burner. It needs to freed from the discriminatory policies and resurrected with necessary incentives and safeguards and provided with benefits similar to the industries such as easy availability of inputs, credit and infrastructure facilities. The Government should strive to channelize greater private and public investment in areas of infrastructural research and development, marketing and processing etc. leading to higher productivity and greater efficiency in agricultural production. Liberalization of agriculture, unless accompanied by a massive step up in public expenditure on agricultural investment and targeted subsidies, along with the necessary rise in increasing revenue to finance these, may prove to be counter-productive. The pressure on land and water resources is seriously threatening native plant and animal diversity. With increasing agricultural and economic development, the genetic pool is declining. This decline if not checked and properly managed, can have unforeseen and adverse consequence for the sustainability of agricultural of the region.

Steady globalization of trade has profound implication for future agricultural development. It is expected that with increasing globalization of markets over the years there will be demands for agricultural intensification. Intensification will not only farming alleviation of rural poverty but also improve resource conservation particularly in the small faring sector where farmers can be encouraged to take up organized production of high value crops such as fruits, vegetables, flowers, medicinal and aromatic herbs etc. Stronger demand for crops of the small farmers will not only improve incomes and welfare but will also make investment in technology and resource conservation more attractive. The general agreement on Tariff and Trade (GATT) and liberalization of global trade is bound to have impact on future land use and production pattern. Therefore, it is necessary to understand the local, national and international environment under which the agricultural production will developed its shape and even crucial in developing strategies.

Extension efforts of the Indian council of Agricultural Research through its research institutes and the state agricultural university were largely limited to demonstration of new technology through programmes such as national demonstration Project, operational research project, Lab to land programme and the Krishi Vigyan Kendras. At present extension programmes are implemented in largely
a top-down fashion leaving little scope for localized planning and action. Farmers are almost passive receivers and their involvement in the process of technology generation and adoption is almost absent. The challenges facing agricultural development call for fundamental changes in our approach to technology transfer/extension programmes. Changes are necessary in the context of changing economic environment following policy adjustments in relation to privatization, deregulation and globalization calling for greater efficiency and effectiveness of the extension system.

There is need for greater emphasis on providing producers with knowledge and understanding needed to overcome the problems or to exploit opportunities of their own specific production system.

- Shift in the focus of public extension system from promoting inputs use to one on sustainable management of resources and improvements in the production system as a whole.

Role of commercial supplier of seeds, agrochemicals, machinery, vaccines and medicines in providing advisories, as is already being done in a limited way, will need to be encouraged and factored in to public system's own priorities.

- Wider and more creative use of mass media in tune with current developments in information technology to get information across to the farming community whose ability to overcome constraints at farm level will increasingly depend on access to reliable and up-to-date information.

**Technological needs and future agriculture in upper Ganga-Yamuna Doab region:**

It is apparent that the tasks of meeting the consumption needs of the projected population are going to be more difficult given the higher productivity base then in 1960's. Previous strategic of generating and promoting technologies were rather serious and contributed problem related to environment and natural resource degradation. In future the technology that were developed and promoted must results not only in increased productivity level but has to ensure that the quality of natural recourse base is preserved and enhanced. Future growth in agricultural needs to be
more rapid, more widely distributed and better targeted. There should be more efficent and sustainble used of increasingly scarce land, water, and germ plasm resources.

Most technological solution will have to be generated and adopted locally to make them compatible with socio-economic conditions of farming community. New technologies are needed to push the yield fronteirs further, utilize inputs more efficiency and diversify to more sustainble and higher value cropping patterns. Potential of less favoured areas must be better exploited to meet the targets of growth and poverty alleviation.

Changes are needed urgently to respond to new demands for agricultural technology form several directions. Increasng presure to maintain and enhance the integrity of degrading natural resources, changes in demand and opportunities arising form economic liberalization, unprecedented opportunites arising from advances in biotechnology, information revolution and most importantly the need and urgyency to reached the poor and disadvantaged who have been bypassed by the green revolution technologies. Another important implication of increasing globalization relates to the need for greater attention to the quality of produced and products both for the domestic and the foreign markets. Adoption to global markets would required state of the art research, which can be achieved only by setting global standards of research, focus on well defined priorities and mechanized which permits close interaction of farmers with researchers, the private sector and market.

**Agricultural Commercialization and Modernization:**

Three types of farming system are found in the upper Ganga-Yamuna Doab. The first type is subsistence system in which the farmer produces food to meet his household requirements. The Second type is semi-commercial system in which farmers give priority not only on maintaining household food-security but also generate some surplus to sell in the nearby market. The third type is commercial system in which profit maximization is the main motive of the farmer. Commercialization of agricultural system leads to greater market orientation of farm production, progressive substitution out of non-traded inputs in favor of purchased inputs, and gradual replacement of integrated farming system by specialized
enterprises. Non-traded inputs like human and animal power is substituted by traded input like mechanical power and farmyard manure by chemical fertilizer. Agricultural Commercialization involves the gradual substitution of complex farming system by specialized enterprise for crop and livestocks in which every farm decision depends on the market signal. Three important factors that drive commercialization are economic growth, urbanization and withdrawal of labor from the agricultural sector. As level of commercialization increases, there is a gradual but definite movement out of subsistence food crops production to a diversified market oriented production system.

As economies grow, there is a gradual movement from subsistence food crops to a diversified market oriented production system. The process of diversification out of staple food production is triggered by rapid technological change in agricultural production by improved rural infrastructure and by diversification in food-demand patterns. As agricultural commercialization proceeds, the marketed share of agricultural output increases. product-choice and input-use decisions are increasingly based on the principles of profit maximization. Commercialization of agricultural system leads to greater market orientation of farm production. The process of commercialization has been accelerating in recent years in the upper Ganga Yamuna Doad region.

As commercial orientation increases, diversification at the agricultural sector level is created by household level specialization, as household shifts away form traditional self sufficiency goals and towards profit and income-oriented decision making with increased responsiveness of farm out put to market needs. Family labour is increasingly replaced with hired labor, as family members find more lucrative non-agricultural employment opportunities. Thus, mechanical power substitutes for human and animal power, chemical fertilizer for manure and other organic fertilizers, and commercial feed for farm-produced fodder.

Rapid development of rural finance system at the grass-root level is an impetus to commercialization, particularly since commercialization of agriculture often leads to large, lumpy payments of cash a few times a year. Supplying reasonably priced loans can speed the adoption of technology, expand the production of food supplies, and increase farm incomes, Effective rural financial institutions can assist
in spreading the benefits of commercialization’s more widely across the community and region. The strong complementarity between commercialization and rural financial-market development has led government to intervene heavily to influence the availability and cost of credit to farmers.

Infrastructure investment play a crucial role in inducing farmers to more towards a commercial agricultural system. Government investments in infrastructure should emphasize genuine public goods such as improving general transport, communications and market infrastructure while allowing the private sector to invest in commodity-specific processing, storage & marketing facilities.

There is a general feeling & sense of insecurity amongst smaller farmers & poor farmers in the upper Ganga-Yamuna Doab region is that commercialization of agriculture in the region would have adverse consequences on them. There are three area of concern: First, is that uptake of modern technologies associated with commercialization may be inequitable process that at least worsens rural inequality and more likely increases absolute poverty. Second, that in the shift to cash cropping, small scale farmers might sacrifice their own food crops and expose their families to greater food, insecurity and third is that commercialization might worsen regional inequities because it favours area that have greater agricultural production potential.

Large farmers of the upper Ganga-Yamuna Doab are the main adopters of the new technology, with better access to irrigation, water, fertilizers, seeds & credit. Smaller farmers are either left unaffected or are made worse off because new technology and green revolution revolted in lower prices, higher input prices and efforts by langer farmers to increase rents or force tenants off the land. It also encouraged unnecessary mechanization, with a resulting reduction in rural wages & employment.

**Impact of Commercialization:**

Commercialization feared is that small farms would left out of the commercialization process and would be unable to compete in the market as competition increase and prices fell. Secondly, if small farmers started producing cash corps for the market instead of traditional food crops, this would increase their
dependence on purchased foods, exposing their households to greater food-security risk because of volatile market prices and uncertain income from cash crops; It also lead to a real location of income within the household in favor of men, with possible adverse nutritional consequences for women & children.

Agricultural commercialization proceeds in some district but not in other can worsen regional disparities, with lagging region or district falling further the behind as commodity prices drop in the wake of increasing productivity in the rapidly growing regions. The widening productivity gap between commercializing regions and slower growing, subsistence - oriented region could not only accentuate relative income differences but even cause an increase in absolute poverty in the lagging region.

Agricultural commercialization should not be expected to be a friction less process, and significant equity and environmental consequences may occur, at least in the short to medium term, particularly when in appropriate policies are followed. There should be appropriate government policies including investment in rural infrastructure & crop improvement, research & extension, establishment of secure rights to land & water, development & liberalization of capital markets, can help in alleviate many of the possible adverse transitional consequences. Important long-term strategies to facilities a smooth transition to commercialization include

- Investment in rural markets, transportation and communications infrastructure to facilitate the integration of markets.
- Investment in education to facilitate labor movements across sectors.
- Investment in crop improvement research to increase productivity and crop management and extension to increase farmer flexibility and reduce possible environmental problems from high input use.
- Establishment of secure rights to land & water to reduce risks to farmers and provide the incentives for investment in productivity and conservation enhancing technology.
- Development & liberalization of rural financial markets to provide liquidity to spread the risks as commercialization proceeds.
Provision of support services, including health, sanitation and nutrition, to transform the income benefits from commercialization in the broader human welfare benefits.

Agricultural Intensification:

In 1965, social scientist long had thought of agriculture change as a cause of population increase rather than as an effect of it. More food would mean more people. Ester Boserup argued that the evolution of agriculture was a process that ordinarily had to be pushed by increasing density of human population. More advanced tools and techniques could squeeze more food from a given amount of land. The "Least intensive" stage involved cropping only about once every twenty years; the most intensive, more than once a year, which usually required much labour for fertilizing and irrigating.

Through human history increasing population growth and changing dietary patterns have resulted in more and more land converted from forest or grass lands into agricultural production. Over the past few decades, the greatly increased use of chemical fertilizers and pesticides, plus changes in irrigation practices and improved seed stock, have enabled land already under cultivation to be farmed much more intensively. Over the long term, increased food production is a prerequisite for a healthy world population. More people will be seeking better diets; and as incomes rise, dietary patterns shift to include more animal protein. The methods used to grow this additional food, as well as the nature and extent of land conversion, will determine whether significant negative health impact will arise. Due to Intensification of agriculture, basic agricultural resources degraded through soil erosion, loss of soil fertility, loss of genetic variability in crops and depletion of water resources. This would eventually deplete agricultural productive capacity.

Intensive agriculture is an agricultural production system characterized by the high inputs of capital, labour or heavy usage of technologies such as pesticides, and chemical fertilizers relative to land area. Modern day forms of intensive crop based agriculture involve the use of mechanical ploughing, chemical fertilizers, plant growth regulators and pesticides, it is associated with the increasing use of agricultural mechanization, which have enabled a substantial increase in production, yet have also
dramatically increased environmental pollution by increasing erosion and poisoning water with agricultural chemicals and destroying forests to make room for farmland.

**Advantages of Intensive Agriculture:**

Intensive agricultural increases yield per acre, per person; food becomes more affordable to the consumer as it costs less to produce. The same area of land is able to supply food and fiber for a larger population reducing the risk of starvation.

**Disadvantages:**

Intensive farming alters the environment in many ways: It destroys the natural habitat of most wild creatures and leads to soil erosion. Use of the fertilizers can alter the biology of rivers & lakes. Pesticides kill useful insects as well as those that destroy crops. If the land is not properly managed, it may results in desertification or the land becomes so poisonous and eroded that nothing else can grow in it. It requires large amounts of energy inputs to produce, transport and apply chemical fertilizers/pesticides. The chemicals used may leave the field as result eventually ending up in rivers and lakes or drain into ground water aquifers. Use of pesticides have numerous negative health effects in workers who apply them, people live in nearby area, area of application or down stream from it and consumers who eat the pesticides which remain on their food.

Modern Intensive farming refers to the industrialized production of animals and crops. The methods deployed are designed to produce the highest output at the lowest cost; usually using economies of scale, modern machinery, modern medicine and global trade for financing, purchases and sales. This practiced mostly in developed nations where most of the meat, eggs, dairy and crops are available in supermarkets and produced in this manner.

In a time span of 20 years from 1984-85 to 2005-06 in the upper Ganga Yamuna Doab, there is intensive use of chemical fertilizers, more intensive use of land, and more use of agro-equipments like tractors, harrow & cultivators, threshing machine, sprayers & seed sown machine. In the year 1984-85 the total chemical fertilizers (NPK) used were 238789 million tones which increased to 442053 million
tones in the year 2005-06. In the year 1984-85, Nitrogen fertilizers used were 192345 million tones, Phosphorus was 36367 million tones & Potash were 10077 million tones which increases to 328844 million tones of Nitrogen, 87856 million tones of Phosphorous & 25353 million tones of Potash in the year 2005-06.

Agro-equipments like tractors, sprayers, harrow and cultivators etc used in greater quantity. In the year 1984-85 the total agro- equipments and machinery used in the region were 251736, which increased to 461427, in the year 2005-06. The total tractors used in the year 1984-85 were 36041 which increase to 135653 in the year 2005-06. The net area irrigated out of the total net sown area in the year 1984-85 were 88.4% which increases to 91% in the year 2005-06. Similarly, the gross area irrigated out of total gross sown area were 81.99% in the year 1984-85 which increase to 97.95% in the year 2005-06.

Similarly, the total sown area in the region (Net sown area+Area sown more once) in the year 1984-85 were 2587151 hec. which decreases to 2242072 hec. It indicate that the land sown mono than once is decreased i.e. mono cropping culture is being followed in the upper Ganga Yamuna Doab, the land is captured by the single cash crop i.e, sugarcane throughout the year and more land is devoted to the sugarcane cops in the entire region.

**Agricultural Diversification:**

Agricultural diversification is an important mechanism for economic growth. It can be facilitated by technological breaks-through, by changes in consumer demand or in government policy or in trade arrangements and by development of irrigation, roads and other infrastructure. It can be impeded by risks in markets and prices and in crop-management practices, by degradation of natural resources and by conflicting socio-economic requirements perhaps for employment generation or for self-sufficiency or foreign-exchange earning capacity in particular crops. Intensification and diversification have been expressly promoted by government policies and facilitated by improved technologies.

In the upper Ganga-Yamuna Doab region, the small and medium size farms are allocated to wheat, oilseeds, vegetable, sugarcane & fodder while less land is
allocated to rice, fruits, cereals, jute cotton & pulses. In case of marginal farms, farms
are allocated to vegetables, wheat, sugarcane, & fodder while less is allocated to
pulses, rice, oilseeds, cotton jute& cereals. Indeed, on small farms the cropping
pattern is determined by household food needs and food crops, thus occupy fourth
fifth of the cropped area. Small holder farmer make frequent changes in crop choice
in order to utilize their family labour and to increase their income. The importance of
quantifying diversification is not encouragement of on farm diversification is seen as
a workable development strategy where with to address the objective of output
growth, employment generation and natural resources sustainability. Smaller (<2 hec.)
farms do practice diversified farming on quite small holding -often fragmented-
farmers allocate their land among seasonal crops, fruits & vegetables, dairy cattle and
poultry to maximize their household-labour utilization and income.

Agricultural diversification helps to achieve food security and improved
human nutrition and increased rural employment. It can also impact favorably on soil
fertility and pest incidence. India's agro-climate regional planning has demarcated the
zones of maximum opportunity for diversified agricultural on smaller farms.

Crop diversification is intended to give a wider choice in the production of a
variety of crops in given area so as to expand production related activities on various
crops and also to lessen risk. Crop diversification is generally viewed as a shift from
traditionally grown less remunerative crops to more remunerative crops. The crops
shift also takes place due to government policies and thrust on some crops over a
given time. Market infrastructure development and certain other price related support
also induce crops shift. Higher profitability and also the residence/stability in
production also induce crop diversification. As in case of sugarcane crop, which is
widely growing in the upper Ganga Yamuna Doad, replacing wheat and rice. Crop
diversification is practice in rainfed land to reduced the risk factor of crop failures due
to drought or less rain. Crop diversification also take places in areas with distinct soil
problems. The factor which are responsible and due to which crop diversification
takes place are.

- Resource related factors covering irrigation, rainfall and soil fertility.
Technology related factors covering not only seed, fertilizers and water technologies but also those related to marketing, storage and processing.

- **Household related factor** covering food and fodder self sufficiency requirement as well as investment capacity.

- **Price related factors** covering output and input prices as well as trade policies and other economic policies that effect these prices either directly and indirectly.

- **Institutional and infrastructure related factors** covering farm size and tenancy arrangements, research, extension, and marketing system and government regulatory policies.

All these factors are interrelated. The adoption of crop technologies are influenced not only be resource related factors but also by institutional and infrastructure factors. Similarly government policies both supportive and regulatory in nature- effect both the input and output prices. Agriculture is increasingly getting influenced more and more by economic factors, irrigation expansion, infrastructure development, penetration of rural markets, development and spread of short duration and drought resistant crop technologies have all contributed to minimize the role of non-economic factors in crop choice of small farmers. Government prices and trade policies are still more powerful instrument for directing area allocation decision of farmers, also crop pattern changes in line with the change in demand-supply conditions. Crop pattern change also lead to serious environmental consequences that take form such as ground water depletion, soil fertility loss and water logging & salinity - all the which can reduce the productivity capacity and growth potential of agriculture over the long term. The rice-wheat sugarcane system in upper Ganga Yamuna Doab replaced traditional crops like pulses, cotton & oilseeds.

The changes in the comparative advantage of crops reflect in reality, the ongoing change in relative prices of inputs & outputs, production conditions, irrigation expansion, development and spread of new crop and farm technologies, extension and input support policies and trade policies and domestic regulations. The changing area share of crop pattern becomes a useful tool for understanding the
direction in which crop pattern changes are influenced by the variations in the comparative advantage of crops and crop groups.

The area shifts and crop pattern changes lead either to crop specialization or to crop diversification. The area share of food grains increased during 1967-76 due partly to their yield advantages created by irrigation expansion and green revolution technologies and partly to government policies pursued to encourage food production and eliminate food imports.

The area share of sugarcane & Potato and to some extent share area of mustard & sugarcane (1995-96) in increasing steadily and those of rice, wheat, barley, Jowar, Maize, Cotton, Matar & used crop are declining gradually in the upper Ganga Yamuna Doab region. The area shifts has favoured the oilseed sector partly because of constant changes in prices and consumers demand of oil. There is a tendency towards sugarcane centered specialization. The area share of crops Potato & oil seeds in increasing and that of other crops decreasing. It indicates a sugarcane cantered specilization. Growth of area under mustard, Potato and sunflower indicates an ongoing structural change leading to diversification within this sector. The sugarcane centered specialization indicates an increase in the supply of sugar but a reduce supply of wheat and rice crop. All these changes in share area of these crops is due to demand- supply graph, domestic demand and international demand.

Constraints in crop Diversification:

Crop diversification in the upper Ganga Yamuna Doab is taking the form of increased areas under commercials crop including vegetables and fruits. This has gained momentum in the last decade favoring increased area under vegetable and fruits and on commercial crops like sugarcane and oil seeds crop. The major problems and constraints in crop diversification are primarily due to the following reasons with varied degrees of influence.

1) 10% of the cropped are of the region is completely dependent on rainfall
2) Over use of resources like land and water, posing a negative impact on the environment and sustainability of agriculture.
3) Inadequate supply of seeds and plants of improved cultivats.
4) Fragmentation of land holding less favoring modernization and mechanization of agriculture.
5) Poor basic infrastructure like rural roads, power, transport, truck communication etc.
6) Inadequate post-harvest technologies and inadequate infrastructure for post-harvest handing of perishable products.
7) Very weak agro-base industry.
8) Weak research-extension-farmer linkages.
9) Inadequate trained human resources together with persistent and large scale illiteracy amongst farmers.
10) Host of diseases and pests affecting most crop plant.
11) Decrease investment in the agricultural sector over the years.

To sustain an operationalized crop diversification, institutional support is required where the crop area is rainfed and 2/3 of the farmers are resource poor. An Accelerated pace of diversification to create positive import of higher income, higher employment and conservation and efficient use of natural resources emphasizes the need for efficient policies, especially in technological development, selective economics reforms and institutional change. In order to ensure social equity, policies on structural adjustment and reforms must pay special attention to the band of marginal and small farmers and agricultural laborers. The direct benefits from diversification should reach the section of the farmers.

**Diversification in Rural Economy:**

The structure of the rural economy in every region or country has been changing along with the overall economy. The farm & non-farm sectors- the two components of the rural economy- have been changing in structure through diversification of activities on the one hand and through increasing employment and income generation on the other.

An economy is sub-divided in to two sub-economies: rural and Urban, on the basis of the size of the settlement and the type of economic activities undertaken by the inhabitants of the region. Rural economy is defined by the predominance of agricultural activities i.e agricultural, and allied activities are the mainstay of the
people living in rural areas, along with many manufacturing and services prevalent to some extent. The rural economy comprises of two sub sectors, farm sector and non-farm sector. Farm activities include agriculture, plantation and animal husbandry (milk, meat, egg etc.), forestry and logging & fishing, whereas non-farm sector includes, activities like agro-processing industries, whole sale and retail trading, storage and communication, transport and education, health industries and other service related activities.

Over time the economy moves and tends to be transformed, means movement/transition of the economy from one stage to another stage of development i.e movement from agriculture to manufacturing and then to services. As economy advances technologically over time, importance of farm sector in terms of its of share in GDP and shares in total employment gets reduced and share of manufacturing and services increases gradually.

Factors influence transformation of the Rural Economy in the Ganga Yamuna Doab region:

1- Mechanization/Technological progress in Agriculture: With the growth of mechanization of agriculture, the input structure of the farm sector changes. Traditional inputs are being replaced by modern inputs like high yielding varities of seeds, biotechnologically engineered seeds, fertilizers, pesticides, irrigation and agricultural implements like tractor, harvesters, harrows, cultivators etc. Use of modern inputs increasing the consumption of energy (petroleum, electricity etc.) which is turn replaces the bullock power in farm agriculture. Adoption of new technology increases agricultural output mainfold. As a results of increase in production, there is a corresponding increase in the marketable surplus. The subsistence farm economy which starts producing for the market becomes market oriented. Farmers of the region are dependent on the market for the purchasing of inputs as well as for selling the farm output. Market expands and along with it the farmer's supply decision are more or less influenced by the market signals.

Technological progress leads to commercialization/capitalization of the farm economy and hence of the rural economy. As production increases, agricultural demand for trading services, storage and communication lifts up. Improved transport
& storage became necessary to handle the distribution and marketing of outputs and inputs.

2- Commercialization: Technological development and adoption of new technology by the farmers necessitate marketing of the farm inputs and setting up of repairing shops and agricultural extension services. This is what being noticed in small towns adjacent to villages of upper Ganga Yamuna region. The non-farm economy in the rural areas gets a boost via the production linkage. As a result, average farm income increases, and consumption of non-farms goods increases. Increased demand for consumer goods and services results in expansion of the rural manufacturing sector and service sectors providing education & medical facilities, insurance and banking facilities etc.

3-Urbanization & Globalization: Economic development which adverse with industrialization and industrialization can not be achieved without a simultaneous process of urbanization. New urban centres emerged and the older ones expanded. As a result, of which cities and towns are growing both in numbers & size. Improved means of transport & communication bring villages more & more closer to urban centres. This process of urbanization is accelerating with the advent of globalization.

The living pattern of the people resides in rural area is changing, which is reflected in the change in demand for agricultural products. Along with demand pattern, crop pattern also changes; relative importance of cereals & non-cereals crops changes. Occupational pattern of the people living in rural villages also changes. As agriculture is the main source of living for the rural people, due to low income, rural people level of living is also low as compare to people of urban areas, but with time non farm activities become the alternative source of livelihood for the rural people. Farm mechanization and commercialization of agricultural is playing an important role in transformation of the rural economy in terms of employment, income and level of living. The volume of non-farm employment and income of the rural people of upper Ganga-Yamuna Doab have been undergoing substantial changes. Increase in per capita income of the rural people due to increased urbanization & non-farm activities changes the life styles and changes the dietary pattern of the rural people. The consumption of high value food commodities like fruits, vegetables, dairy
products has increased both in urban as well as in rural areas and there in a decline in per capita consumption of cereals both in urban and rural areas.

At present and in future, due to trade liberalization, there will be a great demand for high value crops like fruits, vegetable, floriculture products. Trade and investment liberalization will brought about rapid changes in agri-food system as multinational companies are entering in to food market and in agro-processing industries, As a results of which, private investment will increase in storages and modern technologies in agro-processing industries. Consequently, modern warehouse for crops and cold storages for perishables, chilling and processing of milk products will came up in rural areas and more and more non-farm employment will be generated. Improved technology and commercialization of agriculture coupled with growing urbanization and global integration lead to the growth of the rural non-farm sector and with growing urbanization and globalization rural non-farm sector will become more and more service-oriented.

Rural non-farm sector plays an important role in reducing the widespread rural poverty through generation of employment and income and creation of effective demand for goods and services. It will provide diverse employment opportunities to the rural people and in the process will transform the rural economy in the desired direction of inclusive growth. Expansion of rural non-farm sector will increase the number of opportunities of labour and income of the household and also, increase the volume of employment. Diversification of the rural non-farm sector will help in increasing the income of the rural people, provide security and reduces the risk and uncertainty, reduces the pressure of labour on land and reduces the tendency of the rural people to migrate to urban areas.

In rural areas, the economic activities are centered around agricultural and allied activities, its share in total rural national domestic product has gone down continuously and significantly, but the share of other sectors manufacturing & services have been increasing gradually during the period 1970-71 to 1999-2000. It is more or less following the general pattern of development form agricultural to manufacturing and then to services.
With Technological advancement, the linkage between farm & non-farm sectors is getting stronger and multidimensional. Agriculture plays an important role in promoting growth and diversification of the non-farm sector in rural areas as it uses more inputs like modern agricultural implements and chemical fertilizers. The inter-linkage between the farm & non-farm sector becomes important as the agricultural growth promotes growth and employment opportunities in the non-farm sector in the rural economy. Commercial surpluses from agriculture give rise to a whole chain of industrial activities in the rural area of upper Ganga-Yamuna Doab region. Most conspicuous examples are wheat flour & rice milling, oil extraction, Cotton pressing & ginning, sugarcane processing, leather tanning, and leather products, dairy and Poultry products, wooden furniture and fixture and so on. The rising rural incomes push up the demand for the whole lot of non-farm goods including a variety of industrial goods. The demand of local industrial activities are shoes and leather products, pottery, rope making, handlooms, blacksmithy, carpentry, making of jewellery and other wearing apparels, dairy and poultry products, wheat flour & rice milling, raw sugar, beverages and tobacco products & so on.

Planning Perspectives for Agricultural Development:

India has made great progress in providing food security to its people. However, the grown rate of agriculture has decreased from 3.2 during 1985-90 to 2.1 during 1997-2002. There has also been decline in the grown rate of food grain production form 3.22 (1960) to 1.23 (1997); So, food grain production is becoming a great concern for India as well as for the upper Ganga Yamuna Doab region. The upper Ganga Yamuna Doab districts are heading towards semi-commercialization of agriculture. The farmers of the region are growing cash crops like sugarcane & oil seeds, and food crops in order to meet their family needs. According to a study by Bhalla et. al (1999), baseline projection for total cereal demand in 2020 is 246 million tons for direct human consumption. India's population is growing faster than its ability to produce rice & wheat. The relevant questions arises is whether India would be able to increase the food grain production in the coming year with the net-cropped area remaining same. The upper Ganga Yamuna Doab region is one of the region including Punjab, Haryana, that produces much of food grains and where the green reduction shows its impact for the first time in 1960’s.
The required land of investment for the development of marketing, storage and cold storage infrastructure is estimated to be huge. The Government has not been able to implement various schemes to raise investment in marketing infrastructure. Among these schemes are construction of Rural Go Downs, market research and information network & development/strengthening of Agricultural marketing Infrastructure, Grading & Standardization.

Slow agricultural growth is a concern for policy makers as some 60-70% of the people depend on rural employment for a living; Current agricultural practices are neither economically nor environmentally sustainable and the yields for many agricultural commodities are low. Poorly maintained irrigation systems and lack of good extension services are among the factors responsible.

Farmer's access to market is hampered by poor roads, rudimentary market infrastructure and excessive regulation. The low/stagnant productivity in the region is a result of the following factors.

Firstly, now, the irrigation infrastructure is deteriorating.

- The overuse of water is currently being covered by over pumping aquifers and is falling by foot of ground water each year.

- Illiteracy, general socio-economics backwardness and inadequate or inefficient finance and marketing services for farm produce.

- Inconsistent government policy. Agricultural subsidies & taxes of the changed without notice for short term political ends.

- The average size of land holdings is very small and is subject to fragmentation due to land ceiling acts and family disputes.

- Adoption of modern agricultural practices and use of the technology is inadequate, hampered by ignorance of such practices, high cost and impracticality in case of small land holdings.

Over the past 15 to 20 years, increase in irrigated area has mainly taken place from ground water sources. As much as 80-85% of Upper Ganga Yamuna Doab's
agricultural output is ground water dependent. Most of the increase in gross sown area (Net sown area almost remains same) has been achieved from increasing cropping intensity, mainly driven by the development of irrigation. The growth in irrigation intensity is mainly contributed by ground water expansion and increasing level of mechanization. Most of the diversified and mixed farming are taking place in the rainfed part of the cropped area and it contribution in increasing the cropping intensity.

Much of the contribution in yield change in the last two decades, is caused by high fertilizer usage. High use of fertilizer in agriculture production is also contributed by expansion of irrigation as it reduces the risks of investment in fertilizer. Two decades back, farmers applied only 30 kg of mineral fertilizers (nitrogenous, Phosphate & Potassic fertilizers) to their land. Today, they apply 29Kg. per hectare which is three times as much. The excessive use of nitrogenous fertilizers usage in sticking mainly in the irrigated area of the north zone with declining ground water table over use of nitrogenous fertilizers may slow down the yield growth in future from 1990's onwards, there are signs of diminishing returns as a result of decreasing fertilizers productivities and long-term extraction of ground water and soil minerals, and thus, rising the question of sustainability of growth and possible exhaustion of the green revolution potential. It is one of the reason why there is a need & call for a second Green Revelation technology & production by our Prime Minister Dr. Manmohan Singh. With ground water tables declining, there is growing pressure to increase the yield. The key factor behind high yield growth could be the development of new technology that will produce higher yield per hectare and fertilizer remains a key player in this most important task as it has been in the past. The excessive use of fertilizers is mainly confined in the irrigated areas and with declining ground water table over use of fertilizers may slow down the yield growth. The food production is greatly influenced by irrigation & fertilizers usage, The slow growth in yield is contributed by declining ground water table, salinity intrusion, and over use of fertilizers.

With technologies development in Agriculture and rising demand of non-food grain, traditional farming is changing in to modern commercial farming. Our agriculture is increasingly getting influenced more and more by economic factors.
Development of irrigation driven by ground water expansion, infrastructure development, development and spread of short duration and draught resistance crop technologies have all contributed to minimizing the role of non-economic factors in crop choice of even small farmers.

**Agriculture in the Upper Ganga Yamuna Doab: Challenges & prospects:**

Agriculture, the dominant economic activity of the region, faces a number of challenges on various fronts. Some of the challenges facing at present are given:

**Stunted Yield:** The yield of most of the crops has not improved substantially and in cases like wheat, gram, pulses sugarcane & bajra, it fluctuates downward. There is a need to focus on improving productivity.

**Small & fragmented land holding:** The seemingly abundance of net sown area of 1473707 hectares and total cropped area of 2242072 hectares in (2005-06) pales in to insignificance when it is divided in to economically unviable small & scattered holdings. The average size of holdings was 1.19 hectare in 1990-91, which was reduced to 1.08 hectares in 2000-01. Sub-division and fragmentation of the holdings is one of the main cause of low agricultural productivity and backward state of agricultural. A lot of time and labour is wasted in moving seeds, manures, implements and cattle from one piece of land to another. Even irrigation becomes difficult on small & fragmented fields. A lot of fertile agricultural land is wasted in providing boundaries.

**Seeds:** Distribution of assured quality seed is as critical as the production of such seeds. Good quality seeds are out of the reach of the majority of farmers, especially small and marginal, farmers, mainly because of exorbitant prices of better seeds.

**Manures, fertilizers & Biocides:** There are practical difficulties is providing sufficient manures & fertilizers in all parts of the region. Cow dung as manures used is limited because much of the cow dung is used as a kitchen fuel in the shape of dung cakes. Reduction is the supply of fire wood and increasing demand for fuel in the rural areas due to increase in population further complicate this problem. Chemical fertilizers are costly and are often beyond the reach of poor farmers. The fertilizer
problem is therefore both acute & complex. Biocides (Pesticides, herbicides, and weedicides) are used to save the crops and to avoid loses, Indiscriminate use of biocides has resulted in wide spread environmental pollution, which takes its own toll.

**Mechanization:** Although, large scale mechanization is adopted in the districts of Upper Ganga Yamuna Doab region but still small & marginal farmers are making number use of it and this results in huge wasted of human labour and in low yield per capita labour force. Agriculture implements and machinery are a crucial input for efficient and timely agricultural operations, facilitating multiple cropping and there by increasing production.

**Lack of Marketing & Storage facilities:** Lack of marketing & storage facilities and role of brokers deprive the farmers to fetch remuneration prices of the agricultural products. Farmers are still at the mercy of unscrupulous traders and are easily exploited by secret brokerage, false weights and payment of inflated commission. Due to lack in proper pricing policy, farmers fail to obtain fair price for the agricultural produce.

**Inadequate transport:** One of the main handicap of agriculture is the lack of cheap and efficient means of transportation. Even, now many villages are not well connected with main roads or with market centers. Most roads in rural area are Kutcha and becomes useless in the rainy season. Farmers are forced to sell it in the local market at low prices.

**Scarcity of Capital:** Agriculture is an important industry requires huge capital. The role of capital input is becoming more and more important with the advancement of farm technology. Rural credit scenario has undergone a significant change and institutional agencies such as central co-operative banks, State cooperating banks, Commercials banks, Cooperation credit agencies and few government agencies are extending loans to farmers on easy terms.

**Low Status of Agriculture in the Society:** Agriculture is not considered as a dignified and honorable profession. This leads to disappointment and lack of enthusiasm among most of the farmers. The youngsters generation of farmers prefers a
petty government job to agriculture. As a result, there is a mass exodus of people from rural areas to urban areas in search of lucrative jobs.

**Inadequate Agricultural Research & Education, training & extension:** There is no co-ordination between the farm & research laboratories in the different agro-climatic region of the country. The grains of new agriculture researches are not reaching the common cultivators especially the marginal & small farmers. Very little attention is being paid for educating and training farmers for the adoption of new agricultural innovations and techniques to increase their agricultural production.

**Soil Erosion & soil Degradation:** The indiscriminate felling of trees, cattle grazing, unscientific land use practices have greatly accelerated the rate of soil erosion in different parts of the region. The people's awareness and their active participation in the soil conservation is essentially required.

For future development of agriculture what step should be taken to retain its productivity or to increases its production to meet the food requirement of the fast growing population and also to minimize its impact in deteriorating the environment; Also, there is a need for attracting and retaining educated youth in farming recently, a survey conducted by national sample survey organization (NSSO) found that 45 percent of the farmers wanted to quit farming; so, under these conditions where the pressure of population on land in increasing and the average size of farm holding is decreasing, it will become difficult for us in future to persuade educated youth to stay in villages and adopt agriculture as a profession. So, there is a need to improve the productivity and profitability of small holdings through appropriate technologies and market linkages to sell off their farm product. The farmer should get the appropriate price of their product, so that he can earn a descent living in villages and meet other requirements of its needs. There is also need to upgrade farm technologically and economically.

Young educated youth could help rural communities to organize gene-seed-grain-water banks. They can also operate climate risk management centers which will help farmers to maximize the benefits of a good monsoon and minimize the adverse impact of unfavorable weather. They can help to introduce in rural areas the benefits
of information, space, nuclear, bio and eco-technologies. This will take farmers to the pathway to sustainable agriculture and food security as well as agrarian prosperity.

For risk mitigation, there is a need for strengthening and improving existing crop insurance system, aggregating farmers to operate in the future market and ever going value chain financing by the financial institutions. Subsidies on fertilizers, power, seeds, agricultural machinery etc should be given directly to the farmers, especially the small holders and in disadvantageous areas. Investment in rural infrastructure; roads, market, cold chains, processing units as also agricultural R&D will be important to realize higher agricultural growth. Reframing the three T's- namely investments, institutions and incentives- will be critical for bringing in and sealing up innovations in the agricultural sector if all farmers of the region started using recommended high yielding varieties/hybrids, adopt improved practices, use quality seeds and adopt appropriate time of sowing/planting, it will lead to large improvement in productivity as well as quality of produce in many crops.

The next stage of agricultural growth however will face a serious challenging in terms of sustainability. Sustainability in agriculture can be achieved broadly through efficient management of natural resources base and integrated approaches to crop management. In order to be sustainable, agriculture needs to be technologically feasible, economically viable, socially acceptance and environmentally sound. So in future, excessive use of any nutrient, is proving to be unproductive, expensive, wasteful and damaging to the environment. Balance use of fertilizers is helpful in maintaining soil fertility, health, and also taste. So, at present, agricultural growth faces a serious challenge in term of sustainability. Today, the main problem in agriculture pertains to sustainability of resources use and indiscriminate use of chemhical fertilizers and pesticides, Excessive us of chemical fertilizers, chemical pesticides and chemical herbicides has long lasting and deleterious effect on the soil health; on the quality of agricultural produce; health of farm workers, consumers of the agriculture produce and other terrestrial and aquatic life and environment. So, there is a need for more investment in agriculture and rural infrastructure as well as right strategies, policies and interventions, as nearly 60 to 70 percent of the population still depend on this sector for employment.