CHAPTER 1

1.1. INTRODUCTION

Agriculture constitutes an indispensable contributing sector towards the national income and employment, mainly in third world countries or in developing countries. The word agriculture is the English adaptation of Latin agricultura, from ager, "a field" and cultura, "cultivation" in the strict sense of "tillage of the soil". Thus, a literal reading of the word yields "tillage of a field / of fields". Agriculture refers to the production of food and fiber and other goods through farming and forestry. Agriculture was a key development that led to the rise in civilization rising of domesticated animals. It was developed at least 10,000 years ago, and it has undergone significant developments since the time of the earliest cultivation. Evidences point out to the Fertile Crescent of the Middle East as the site of the earliest planned sowing and harvesting of plants that had previously been gathered in the wild. Independent development of agriculture is also believed to have occurred in Northern and Southern China, Africa's Sahel, New Guinea and several regions of the America.

The Neolithic founder crops of agriculture appear first ever was wheat and einkorn wheat, then hulled barley, peas, lentils, bitter vetch, chick peas and flax. Bitter vetch and lentils along with almonds and pistachios appear in Franchthi Cave Greece simultaneously, about 9,000 BC. Neither is native to Greece, and they appear 2,000 years prior to domesticated wheat in the same location. This suggests that the cultivation of legumes and nuts preceded that of grain in some Neolithic cultures.
By 7000 BC, small-scale agriculture reached Egypt. From at least 7000 BC the Indian subcontinent saw farming of wheat and barley, as attested by archaeological excavation at Mehrgarh in Balochistan. By 6000 BC, mid-scale farming was entrenched on the banks of the Nile. About this time, agriculture was developed independently in the Far East, with rice, rather than wheat, as the primary crop. Chinese and Indonesian farmers went on to domesticate taro and beans including Mung, Soya and Azuki. To complement these new sources of carbohydrates, highly organized net fishing of rivers, lakes and ocean shores in these areas brought in great volumes of essential protein. Collectively, these new methods of farming and fishing are inaugurated a human population boom dwarfing all previous expansions, and is one that continues today. By 5000 BC, the Sumerians had developed core agricultural techniques including large-scale intensive cultivation of land, mono-cropping, organized irrigation, and use of a specialized labour force, particularly along the waterway now known as the Shatt al-Arab, from its Persian Gulf delta to the confluence of the Tigris and Euphrates. Domestication of wild aurochs and mouflon into cattle and sheep, respectively, ushered in the large-scale use of animals for food/fiber and as beasts of burden. The shepherd joined the farmer as an essential provider for sedentary and semi-nomadic societies. Maize, manioc, and arrowroot were first domesticated in America as far back as 5200 BC.

The potato, tomato, pepper, squash, several varieties of bean, tobacco, and several other plants were also developed in the New World, as was extensive terracing of steep hillsides in much of Andean South America. The Greeks and Romans built on techniques pioneered by the Sumerians but made few fundamentally new advances. Southern Greeks struggled with very poor
soils, yet managed to become a dominant society for years. The Romans were noted for an emphasis on the cultivation of crops for trade.

During the Middle Ages, Muslim farmers in North Africa and the Near East developed and disseminated agricultural technologies including irrigation systems based on hydraulic and hydrostatic principles, the use of machines such as norias, and the use of water raising machines, dams, and reservoirs. They also used location-specific farming manuals, and were instrumental in the wider adoption of crops including sugar cane, rice, citrus fruit, apricots, cotton, artichokes and saffron. Muslims also brought lemons, oranges, cotton, almonds, figs and sub-tropical crops such as bananas to Spain. The invention of a three-field system of crop rotation during the Middle Ages, and the importation of the Chinese-invented moldboard plow, vastly improved agricultural efficiency. Another important development towards the end of this period was the discovery and subsequent cultivation of fodder crops that allowed over-wintering of livestock. By the early 1800s, agricultural techniques, implements, seed stocks and cultivated plants selected and given a unique name because of its decorative or useful characteristics had so improved that yield per land unit was many times that seen in the Middle Ages. With the rapid rise of mechanization in the late 19th and 20th centuries, particularly in the form of the tractor, farming tasks could be done with a speed and on a scale previously impossible. These advances have led to efficiencies enabling certain modern farms in the United States, Argentina, Israel, Germany, and a few other nations to output volumes of high quality produce per land unit at what may be the practical limit.

Indian agriculture began by 9000 BC through adoption of early cultivation of plants and domestication of crops and animals. Settled life soon
followed with implementation and techniques being developed for agriculture. The middle age saw irrigation channels reach a new level of sophistication in India. Indian crops were affecting the economies of other region of the world under Islamic Patronage. Land and water management system were developed with an aim of providing uniform growth in the economy. At present, agriculture is considered as the backbone of the Indian economy. More than 60 percent of our total population earn their livelihood from agriculture. Besides, the growth of Indian economy requires a high degree of agricultural development to sustain a desirable rate of economic growth. Agricultural development would generally lead to more employment opportunities in the construction of small irrigation works, drainage system, contour bounding, terracing etc. It is well recognized fact that, the agriculture is the largest sector of economic activity and plays a crucial role in India’s economic development by providing food and raw materials and employment to a large proportion of the population. Food grains play a major role in agricultural production, which constitutes 65 percent (CMIE, Dec 2008) of the gross cropped area of the country. Rice and Wheat among the cereals and Maize among the millets take a large share in the country’s agricultural economy. Pulses are also grown in different quantities in different regions of the country.

However, the importance of development of agriculture in India is to strengthen the rural economy of the country has been emphasized by scholars, administrators since the beginning of the twentieth century. Indian agriculture in the pre-independence period was usually described as a gamble of monsoons. There had been a great deal of uncertainty about crop prospects, as monsoons played a decisive role in determining agricultural output and their failures resulted in widespread famine and misery. At the time of our
independence, the country had to depend on imports to meet the domestic demand for food.

After independence, particularly since 1951, the Planning Commission has initiated various programmes for development of agriculture and the sector was given highest priority so that the country can produce enough food to meet the growing requirement of its burgeoning population. In spite of the fact that agriculture was given the topmost priority on almost every Five Year Plan, the first two decades after independence witnessed a slow pace in the growth of agricultural production. From the base of 50 million tonnes in 1950-51, the food grain production had risen only to 75 million tonnes by mid sixties (Mander & Sharma, 1995) and till then the country had to depend on imports of food, which led to crisis of foreign exchange reserves and balance of payments. The introduction of new technology during the Fourth plan has changed the shape of Indian agriculture. The New Agricultural Strategies (popularly known as Green Revolution) had emerged as a big hope from the cropping session of 1966-67 and consequently India’s production of food grains especially that of wheat and rice increased sharply. The total food grains production in 1950-51 was 51 million tonnes, which increased to 82.0 million tonnes in 1960-61, 108.4 million tonnes in 1970-71, 129.6 million tonnes in 1980-81,176.4 million tonnes in 1990-91,196.8 million tonnes in 2000-01, 233.9 million tonnes in 2008-09. This shows that the country has definitely achieved considerable improvement in agricultural production.

However, the new technology did not bring about a breakthrough uniformly in agricultural production in all the states of the country. Progress made by some states in this field has been better as compared to others. Such variations in production are also found in different districts of a particular
state. However, in a vast country like India with marked regional diversities in agro-climatic environment, resource endowment and population density is likely to be characterized by uneven development among regions. The performance of agricultural sector of eastern India, which is characterized by rain fed agriculture, had remained somewhat dismal. Uttar Pradesh and west Bengal have shown a strong growth particularly in rice and wheat since early 1980s. In Assam, the yield rates of some principal crops such as rice, wheat, jute, sugarcane, rape and mustard etc have increased slightly from 1960-61 to 2007-08. However, the productivity of major crops in Assam is far less than the national average.

North-Eastern region of India has got its definite identity due to its peculiar physical, economic and socio-cultural characteristics. The economy of North-Eastern India is also full of potentialities as different valuable natural resources are within the possession of this region. The region comprises of eight states namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura having foreign boundary with Bangladesh in the west, Myanmar in the east and Tibet region of China and Bhutan in the north. The region may be safely divided into two broad division—Plain region which comprise of 27 percent (i.e.68.96 lakh hectares) of the total geographical area of NER and Hill region which comprise of the states like Arunachal Pradesh Meghalaya, Mizoram, Manipur, Sikkim, Nagaland and Karbi Anglong and North Cachar hills of Assam. In the region the monsoons usually start in June and last until the end of October. Rainfall in the region is usually heavy due to its peculiar geographical position. The annual rainfall ranges from 70 inches in plains to 250 inches or more in the hills. The soil of NER is normally acidic in nature. There is much acidity on the soil of the hills whereas new alluvial soils
representing the lands on the river banks are less acidic. The phosphoric content of the upper Brahmaputra valley where tea is grown is good but it is low in the lower valley. There is high proportion of nitrogen and organic matters in the soil of hill areas in the region. In the hill states of the region, fruit trees respond quickly as its soil contain heavy clays with a high percentage of organic matter. The development of secondary and tertiary sector in the region is comparatively poor; more than 60 percent of the total population in the region depends on agriculture for its livelihood.

Assam is the North-Easternmost state of the Indian union and is located between 24°08' and 27°58'N latitudes and 89°42'E and 96°01'E longitudes. Geographically, Assam is surrounded by Bhutan and Arunachal Pradesh on the North, Nagaland and Manipur on the East, Meghalaya and Mizoram on the South and Bangladesh, Tripura and West Bengal on the West. Since independence, many changes have taken place in Assam geographically and in many other respects. At present, total land area of it is 78,523 sq. kms. It accounts 2.4% of the total geographical area of the country. Demographically, Assam is the most populous state in the North East India. Economically, out of the eight North East States, Assam is comparatively more developed than the others. But compared to other states like Maharashtra, Tamil Nadu, Gujarat, Assam lags far behind in almost all economic spheres. The economy of the state is predominantly agricultural with a total cultivable area of 38.39 lakh hectare (2007-08) which constitutes 48.9 percent of the total geographical area. Net shown area (more than once) is about 10.86 lakh hectares, which is about 28.3 percent of the cultivable area. The cropping intensity of the state is 139.4 percent (2007-08) (Directorate of Agriculture, Govt. of Assam 2011). The average operational holding is 1.15 hectare only and more than 83 percent of the farmer family is small and marginal farmers. The contribution of
the agriculture sector to the GSDP (at constant prices; 1999-2000 prices) was pegged at 22.85 per cent in 2007-08 (Quick estimate) after steady decline from 32.24 per cent in 1999-2000. However, this sector continues to support more than 75 per cent population of the State directly or indirectly providing employment of more than 53 per cent of the workforce. The state is producing both food and cash crops. The main food crops in Assam include rice, wheat, pulses, potato, maize and the cash crops of the state are tea, jute, oil seeds, and sugarcane. The area under food crops in Assam increased up to 26.70 lakh hectare in 2008-09 (NEDFI Databank), which accounts for nearly 65.6 percent of the total cultivable area of the state. Among various important crops in the state, the area under rice dominated the position, sharing about 92.2 of total food cropped area in 2007-08.¹

Geographically, Assam is divided into two valley ---- Brahmaputra valley and Barak valley. Sonitpur district is situated in the North bank of Brahmaputra valley. It is an important district from both economic and historical point of view. Sonitpur district lies between 92°16' to 93°43' East longitudes and 26°30' to 27°01' North latitudes. It covers an area of 5324 sq. km. Total geographical area covered by the district was only 6.8% of total geographical area of Assam. The border of the district attach with Arunachal Pradesh in the north, lifeline of Assam river Brahmaputra in the south, Lakhimpur district in the east and Darrang district in the west. The district has 3 Sub-divisions, 14 Development Blocks and 3 Agricultural Sub-division and 1693 villages. Agriculture is the main source of livelihood of the population of the district. More than 60% of population engaged in Agriculture. The main crops of the district are rice, tea, pulses, oil seeds (mustered), jute, and sugarcane. The economy of the district is predominantly agrarian and village

¹ Economic Survey, Assam 2008-09
centric. The total cropped area in the district is 146128 hectare, which is only 3.66% of total cropped area of the state. As per 2011 census total numbers of farmer families was 157118, out of which 37% is small farmers, 35% marginal farmers and 16% landless farmers and 12% big farmers. Tea is the important Cash Crops in the district. There are 88 tea gardens in the district covering 30.6% of total cultivable area under ADO Circle. The main crops cultivated in the district are rice wheat, jute, tea, sugarcane, maize, oilseeds, etc. There is the variation in yearly production of the main crops in the district. The yield rate of some of the crops in the district similar to the state average, but it is quite low in comparison to the leading states in India. For example, the yield rate of wheat in the state is quite low in comparison to the national average i.e. 2762 kg/hec. in 2001-02 and 2700 kg/hec in 2008-09 and in Punjab it was 4179 kg/hec. Similarly productivity of oil seeds is also low (750kg/hec) to national average of 925 kg/hec in 2008-09.

The agriculture, which is the main source of livelihood in the State as well as in the District are suffering from low productivity. The agricultural sector in the district has not developed significantly. Agriculture in Assam solely depends on vagaries of monsoons, which creates unexpected havoc on the agricultural production in the district as well as in the state. Except tea plantation, the annual crop cultivation, the small peasant families who are living in rural societies carry out especially food crops. But it is disappointing to note that they have been facing varieties of problems over which they have little control because of extreme lack of capital, technical know how and other resources. The important problems constraining agricultural development and innovation in the district may be summarized in four categories as --- natural, biological, techno-economic and socio-cultural. The natural problems include flood, drought, soil erosion, etc. The biological problems are pests and
diseases, unhealthy peasants and draught animals; while the problems such as surplus manpower, insignificant use of inputs like improved seeds, fertilizers, pesticides and insecticides, modern implements, irrigation, finance, inadequate market facilities and price incentives, adverse land policy and legislation, lack of agricultural research and inefficient extension services are included in techno-economic problems. Among the multitude of socio-cultural problems, conservative outlook of the farmers, ill fatalism, ignorance, illiteracy and antiquated organization of agriculture are found to be of great importance.

1.2. NEEDS AND SIGNIFICANCE OF THE STUDY

Agriculture is considered as the mainstay of the economy of Assam and thereby it stands as the backbone of the economy of the state. From the very early period agriculture and its allied activities like animal husbandry, forestry, fishing etc. has been contributing the major portion to our state income. In 1950-51, agriculture and allied occupations contributed about 52.2% of the total state income. Although the share of agriculture to the state income has been declining gradually due to the growth of other sectors in the economy but the share remain still high in comparison to the comparatively developed states of the country. As for example, the share of agriculture to the state income has declined to 32.1% in 1970-71 and then increased to 44.2% in 1980-81 and then declined to 22.89% in 2008-09(quick estimate) as compared to that of 18% for all India.

In Assam more than two-third of our working population are engaged in agriculture directly and thereby depends for their livelihood. As per 2011 census, about 56% of the total working force is engaged in agriculture and allied activities. In 2001, cultivators alone constitute 52.4% of the total main
workers of the state and taking together the agricultural labourers, they constitute about 70.2% of the total main workers of the state. In an industrially developed states like Maharashtra, Gujarat, Tamil Nadu and West Bengal, the proportion of people depending on agriculture for earning their livelihood is much less in comparison to industrially backward state like Assam.

Another important role of agricultural sector in the state’s economy is that it is the only major source of food supply and thereby providing regular supply of food materials to the increasingly growing population of the state. In the pre-independence period, Assam was a food surplus state. But in the post-independence period, the state is turned into a food deficit state due to high rate of population and a comparatively slower growth rate in the production of food grains. Total production of food grains in Assam has increased from 16.79 lakh tonnes in 1960-61 to 35.04 lakh tonnes in 2007-08 (Directorate of Economics and Statistics). Besides agriculture in Assam has been the major source of supply of raw materials to various important agro-based industries of the state. Tea plantation is the source of raw materials for the famous age old tea industry of Assam. Moreover, sugar industry, vanaspati mills, oil crushing mills, rice husking mills, sericulture etc. are also getting their necessary raw materials from the agricultural sector of the state. Besides agriculture can provide a market for industrial products as increase in the level of agricultural income may lead to expansion of market for various industrial production of the state.

The prospect of planning in Assam also depends very much on agricultural sector. A good crop always provides impetus towards a planned economic development of the country by creating a better business climate for
the transport system, manufacturing industries, internal trade etc. A good crop also brings a good amount of finance to the state government for meeting its planned expenditure. Similarly, a bad crop leads to a total depression in the business condition of the state, which ultimately leads to a failure of economic planning. Thus the agricultural sector is playing an important role in the state like Assam. Moreover, the backwardness of the economy of the state has also resulted from poor condition of the state’s agriculture and similarly the prosperity of the state’s economy still largely depends on agricultural sector.

Similarly, agricultural sector is also playing an important role in the Sonitpur District of Assam. Agriculture is the largest productive sector in the district and it provides livelihood of more than 60% of total population, but are suffering from low productivity. According to District wise physical target of rice under 20 point programme for the year 2007-08, the yield rate of rice is around 1500 kg/hec., whereas national average for year 2006-07 was 2125 kg/hec. The yield rate of wheat in the district is 1600 kg/hec whereas in Punjab it was 4179 kg/hac in 2006-07 and national average is 2700 kg/hec. for the same year. Similarly, the yield rate of rapeseeds and mustard was 750 kg./hec. whereas in national average was 925 kg/hec. in 2006-07. So, productivity of the major crops is quite low in comparison to other states and national average. There are different factors responsible for the low productivity of agriculture sector in the district. The average size of operational holdings is 1.27 hectares. Of the total operational holding 60% are of size less than 1 hectare. This small holding along with growing fragmentation of land stands in the way for modernization of agricultural productivity in the state. Agricultural productivity in the district is also affected by inadequate irrigation facility. Only 11.7% of total cropped area
was under irrigation facility whereas the state average was 17.17%, in Punjab 92.9%, in UP 68.7%, and in Bihar 49.4%. The farmers in the district are still following the orthodox method of cultivation. They are still relying on centuries old wood-plough and other traditional equipments, whereas some other states like Punjab, Haryana, Andra-Pradesh, they replace their technology with modern technology. The scantly use of HYV seeds and fertilizer also affects the productivity of the district. The seeds replacement rate was below 5% in the district whereas 10% is the state average. In other states this rate is quite high. Similarly, consumption of fertilizer in the district was only 20.55 kg/hec. Consumption of fertilizer in national average, it was 104.5 kg/hec. in 2004-05 and 113.3 kg/hec. in 2006-07. Besides, inadequate credit facility to poor farmers in rural areas of the district also causes low productivity in agricultural sector. The percentage share of rural sector to total credit was only 10.6% in 2000-01. In contrast, the share of agricultural sector in total bank credit was 18.9% in Punjab, 23.2% in Rajasthan, 17.7% in Haryana and 17.9% in Andra-Pradesh in 2000-01. Due to all these reasons the productivity of the agricultural sector in the district is quite low in respect to other region. So, it is an urgent need to develop agricultural infrastructure in the district so that the constraints regarding low productivity can be minimized.

From the above short analysis it becomes necessary to study the different aspects of constraints and prospects of agricultural development of the district. The study becomes quite significant because, no research work from the agricultural and economic perspective has been carried out in the district so far. Besides, the study is considered to be of great significance not only to the academicians but also to the planners for formulating agricultural development strategy for the district. It is our endeavor to study the
“Problems and Prospects of Agricultural Sector in Assam- A case study of Sonitpur District”. So it is hoped that this study will be of immense importance for all concerns.

1.3. OBJECTIVES OF THE STUDY:
The main objectives of the study are-

1. To study the existing scenario of agricultural sector of Assam as well as Sonitpur district.
2. To examine the productivity of the major crops of Assam in general and Sonitpur district in particular since 1991 (Post reform period).
3. To identify the factors affecting in adoption of modern and improved practices by farmers in the district of Sonitpur.
4. To evaluate the constraints and prospects of agricultural growth in the state as well as Sonitpur district.
5. To suggest how Agricultural development can be expedited.

1.4. HYPOTHESIS FOR THE STUDY:
The proposed hypotheses for the study are as follows-

1. Agricultural productivity can be increased by providing adequate infrastructure and input facility.
2. Agricultural Development in the District has been very much insignificant.
3. The size of land holding and their fragmentation retards efficiency of cultivation in the district.

1.5. RESEARCH METHODOLOGY:
The study attempts to examine the constraints and prospects of agriculture in the District at both micro and macro level. Hence, the study uses both primary and secondary data.
The macro level analysis is mainly based on secondary data. The relevant secondary data will be collected mainly from the Directorate of Economics and Statistics, Department of Irrigation, Directorate of Land Records, Block Development Offices and other Govt. Departments and agencies involved in agriculture and rural development. Land used and cropped data will be collected from the Revenue Circle and District Agriculture Offices. Besides, secondary data will be collected from Five Year Plan documents, journals and periodicals, publications of research articles and nongovernmental publications. On the other hand, population data can be collected from census reports of India.

The micro level analysis is mainly based on Primary data collected by carrying out field survey, interviewing on sampling basis. Data and information from sample villages are collected through questionnaire.

Growth rates are expressed in two forms “linear” and “compound”. In the study, compound growth rates have been estimated for area, production and productivity by fitting a semi logarithmic trend function of the form:

\[ Y = e^{a+bt} \]

Where,

- \( Y = \) Area/Production/Yield
- \( a = \) Constant
- \( b = \) Growth Rate
- \( t = \) Time.
In order to measure variability, co-efficient of variation and standard deviation have been estimated for different period using the following formula:

(i) \( C.V = \frac{\text{Standard Deviation}}{\text{Mean}} \)

(ii) \( S.D = \left[ \frac{\sum (x_i - \bar{x})^2}{N} \right]^{1/2} \)

Where,

- \( N = \) Total Number of Observation
- \( x_i = \) Area/Production or Productivity
- \( \bar{x} = \) Mean of the Distribution

Further, variance of production is decomposed into its constituent sources viz. area variance, yield variance, area-yield co-variance and higher order interaction between area and yield to examine the source of instability.

In order to study inter-district variation in cropping pattern, percentages of area under principal crops across the state’s district at different points of time are calculated. To minimize the influence of seasonal factors triennial averages of the area of principal crop/crop categories are calculated. Percentage change of area under different crops has been worked out.

1.6. PLAN OF STUDY:

The plan of study is based on the following tentative chapters.

Chapter 1: Introduction. This chapter has been exclusively devoted for the introduction of agriculture in the state and the district in particular, its background, needs and objectives etc. the discussion in the chapter is done on the following sub-heads:
a. The background of the study.
b. Needs and significant of the study
c. Objectives of the study.
d. Hypothesis of the study.
e. Research methodology.
f. Chapterisation.
g. Periodicity of the study.
h. Review of literature.
i. Limitations of the study.

Chapter 2: Existing Scenario of Agriculture and Land Use Pattern in Assam as well as Sonitpur District. The present state of agricultural economy of Assam and district has been highlighted in this chapter. The climate, rainfall, quality of soil in the different agro-climatic zones, nature of cropping pattern, land holding system, land use pattern have been examined in this chapter.

Chapter 3: Cropping Pattern and Trends in Productivity of Selected Crops during Post Reform Period in the District. In this chapter variation of cropping pattern under the principal crops in the district and across the state’s district has been discussed by using appropriate statistical technique. Trends in productivity of some selected crops also discussed in this chapter.

Chapter 4: Inter-District Variation in Productivity of Selected Crops in Assam. In this chapter variation in productivity of selected crops across the state’s districts has been discussed. A comparative study with agriculturally developed state has been done in this chapter.
Chapter 5: Economic Reforms and its Impact on Agricultural Sector in Assam as well as Sonitpur District. This chapter has been exclusively devoted for the study of impacts of economic reforms adopted by Indian government under New Economic Policy 1991, on the agricultural sector of Assam and the district in particular. A comparative study of agricultural production of the state with that of some of the major agricultural state of the country has also been made in this chapter.

Chapter 6: Constraints and Prospects of Agricultural Sector in Assam as well as Sonitpur District. This chapter deals with the factors affecting agricultural productivity in the district and the state as well. It examines the degree of impact of these factors on agriculture and also analyzes the future prospects of the sector.

Chapter 7: Summary of Findings, Recommendations and Conclusions. This is the concluding chapter summarizes the findings of the study. A discussion on policy measure for stepping up agricultural productivity in the district and in the state has been discussed in this chapter.

1.7. PERIODICITY OF THE STUDY:

The study of constraints and prospects of agricultural sector in Assam is mainly concentrated on the agricultural productivity of Sonitpur District. The main emphasis of the study is given on the agricultural productivity and factors affecting the performance of main crops in the district during 2000-2010.

1.8. REVIEW OF LITERATURE:

Although agriculture is an important sector of an economy, importance of formal study on this sector attracted the attention of researchers as early as in the time of Adam Smith. All the classical economists were interested in
studying the growth behaviour of agriculture for explaining the growth of the economy. First attempt of agricultural study was made by Baker (1926), Johnson (1925-26), Jones (1928-30) and Taylor (1930). Their study devoted mainly to agricultural regionalization in order to establish the broad spatial pattern. In Indian agriculture, also many experts have made studies in this field and come out with findings of their own. The findings of these studies are summarized in the following few paragraphs.

Rao (1962) made a study on agricultural production and productivity in India and observed that during the period 1949-50 to 1960-61, agricultural production in India had increased by 36.4%, whereas increase in the average yield per acre was only 18.6%, the rest of the increase in production being accounted by an increase in the area under cultivation. The study revealed that during the period 1949-50 to 1960-61, acreage contribution was more than the agricultural productivity to the total agricultural production of the country. He further pointed out that increase in production by increase in acreage would not be available after the 2\textsuperscript{nd} plan, so the yield per acre had to be increased as this would be the only solid and enduring base for the required progress in our agricultural production in the coming decade. He mentioned that one of the factors contributing to increased productivity during the period had been for the change in the cropping pattern, as the share of the higher yielding crops had increased with one significant exception, namely rice (1.12%).

Sen (1967) in his study on growth and instability in Indian agriculture concluded that certain amount of fluctuation was unavoidable in food grain production because of weather hazards. A study of the data of food grains production during the first twenty-four years of the twentieth century showed that with the rise in food grains production, the instability was also on the
increase. In the next twenty-four years food grain production showed a declining trend but less unstable. An analysis of the data for 30 years period, 1936-37 to 1965-66 also revealed that instability tended to increase with the rate of growth. Sen. suggested that the increased growth after independence up to 1965-66 was primarily based on the expansion of area under cultivation. He hypothesized that the new area being brought under cultivation was land of poorer quality and hence more susceptible to weather fluctuation. In the mid sixties, there had been no significant change in the output growth rate. The main source of growth had been the increase in land productivity, rather that continuing expansion in cultivated area.

Khan (1969) in his study on the growth in the production of food grains crops in Bihar during the period 1950-51 to 1965-66 concluded that the increase in production was due to increased productivity rather due to expansion in acreage. The productivity per acre of all crops had increased during the period. He also revealed that during the period 1950-51 to 1965-66, the net area sown had been reduced by 3% but there had been an expansion of acreage under food grains crops mainly through increased intensity of cropping as well as shift in acreage from non-food grains to food grains crops.

Srinivasan (1979) studies the trends in agriculture in India for the period 1949-50 to 1977-78, showed that there had been a decline in the rate of growth of gross sown area in particular under non-food crops in the decade starting from 1967-76 compared to the fifteen years ending in 1964-65. However, the output of food crops and all crops grew more or less uniformly over the entire period with no evidence of either acceleration or deceleration since 1967-68. As wheat showed a faster growth in output and yield per unit
area in the later decade, it was concluded that there was no green revolution but it was wheat revolution.

Alagh and Sharma (1980) studied the growth of crop production for the period 1960-61 to 1978-79 by dividing the period into two equal sub period, 1960-61 to 1969-70 (period I) and 1969-70 to 1978-79 (period II). The study concluded that Green Revolution had an appreciable effect on the Indian economy since 1969-70 as the period II showed a higher growth rates for all crops at all India level as compared to period I. The study also revealed that growth in period II was more evenly spread than period I, but the variation around the growth was as large as the first period. Thus, the problem of fluctuations of agricultural output was an extremely serious one for the Indian economy.

Hazell (1982) made a study on instability in India’s food grain production for the period 1952-53 to 1977-78 (omitting the drought year 1965-66 and 1966-67). By using variance decomposition method, he found that the lion’s share (82%) of increase in production variance was due to increase in the co-variances of production between crops grown in the same and in different states. Furthermore, increase in inter-crop and inter-state yield co-variances was the dominant source of the increase in these production co-variances. He concluded that aggregate production instability was an inevitable consequence of rapid agricultural growth. So, policies such as storage and trade policies should be attempted to stabilize consumption.

Chakrabarti (1982) studied the growth pattern of food grain production in India from 1949-50 to 1975-76 by using cycle-adjusted time series data. He found that with the elimination of cycle, the series had three distinct Segment I from 1949-50 to 1960-61, Segment II: 1958-59 to 1966-67 and
Segment III: 1964-65 to 1975-76. The study revealed that the food grain production was stagnant during the second period. With the introduction of high yielding varieties with associated improved critical inputs, the growth rate in food grains showed a vertical jump from stagnancy at the beginning of the segment III. Subsequently it showed the same behavior as in segment I. thus, the study concluded that through technological breakthrough in the field of food grain production, the country had regained the growth pattern that was prevailing prior to the stagnancy period (segment II) i.e. prior to 1958-59.

Ray (1983) emphasized that for investigation of growth and instability, a model incorporating controllable man-made factors and uncontrollable weather factors in the specification was more illuminating and useful for policy purposes. He concluded that major causes for changes in the pattern of growth and instability in production were (I) an increase in the variability of rainfall and price and (II) an increase in the sensitivity of production to variation in rainfall and price.

Parthasarathy (1984) examined inter-district variation in the growth rates and fluctuation of agricultural production in Andhra Pradesh for the period 1955-56 to 1978-79. He found that the degree of instability in agricultural production was high in all the districts. It was higher for food-grains than for “all crops”. The post Green Revolution period showed a higher degree of instability. The district, which achieved higher growth rates were also subject to greater instability.

Johl (1984) was of the opinion that with reasonable effort and concerned, food grain production and for that matter, agricultural production can be considerably increased through an improvement in productivity. He opined that with the available production technology and the given cropping
pattern in different agro climatic zones of the country, there was tremendous potential for increasing productivity through the application of additional inputs and better management of resource use. Even if no improvement in production technology is assumed, there is an easy possibility of enhancing production by expanding by expanding the horizontal and vertical expansion of crop area. Further he mentioned five set of determinants for growth and development of agriculture- adequate and growing research capacity, extension education through matching delivery and recipient systems, adequate rural infrastructure to interact with socio-economic super structure, conducive agricultural policy environment and responsive and dynamic farming community, in addition, to the independent effects of these determination, have a high degree of interaction effect. Such a framework is pre-requisite for achieving rapid agricultural growth and development of any area, region and state of the country.

Dev (1885) made an analysis to study whether the new strategy of agricultural development, which was identified with HYV technology, had widened regional disparities in agricultural performance. He examined change in regional disparities for all crops in terms of output per area and output per capita (to take account of demographic pressures) and the interconnections between the two measures across agro-climatic region in late 1970s as compared to early seventies and sixties. He concluded that at the level of agro-climatic regions, rich regions are becoming relatively richer in terms of output per unit area. Though poor regions had not become poorer, they had remained relatively poor in terms of output per area. But they had become poorer in terms of output per capita.
Chattopadhyay and Bhattacharya (1986) in their study found that breakthrough in production condition through the evolution of HYV technology around 1965 had taken place in such a scattered and fragmentary way that they had little impact on the country as a whole. The analysis also mentioned that except for some commercial crops like, potato, sugarcane, the new technology in agriculture had no impact on inferior cereals and had little impact on superior food crops. By making a comparative study of growth rate of agricultural production for two states – Punjab and West Bengal, the study concluded that the effects of new technology on agricultural output of different varieties of crops were different in the different regions.

Ranade (1986) made a study on growth of productivity in Indian agriculture by extending late Dharm Narain’s article on the sources of agricultural productivity during 1952-53 to 1972-73 in India. Dharm Narain had shown that in the period prior to the Green Revolution, the locational shift of crops had significantly contributed to growth along with the cropping pattern effect, while in the later period; it was the pure yield effects which was mainly responsible for growth. Ranade discovered certain anomalies in the data used by Dharm Narain. By correcting the data for those anomalies and extending the analysis for the period 1972-73 to 1982-83 and examining the locational shift effect to the growth of production of rice, he found that pure yield effect made substantially lower contribution in the post Green Revolution periods as compared to that in the previous period. The locational shift, in fact became important in the Post Green Revolution period as area under short duration rice varieties expanded in Punjab and Haryana.

Dantwala, (1987) remarked that agricultural performance during the period from 1949-50 to 1985-86 had been particularly impressive, especially
in food grains. In fact, the annual compound growth rate of major food grains had registered an increasing trend from 2.16 per cent during 1950-51 to 1967-68 to 2.62% during 1967-68 to 1983-84 and thereafter to 3.00% during 1973-74 to 1983-84.

Pal and Sirohi (1988) studied the sources of growth and instability in the production of commercial crops and changes in their pattern in India. Two time period viz. 1950-51 to 1964-65 and 1967-68 to 1983-84 were considered for the analysis. The study concluded that growth and stability in production of commercial crops were complementary rather than competitive processes in intensively irrigated regions. Instability was more prominent in disaggregate production at the state level and might be much higher at the farm level. As far as sources of variance are concerned, area variability contributed more than 60 percent to the variance of production in sugarcane and jute in both the periods. Conversely, yield variability accounted for nearly 75 percent and 54 percent of the variance of production in groundnut and cotton respectively. They laid emphasis on adopting yield stabilizing policies in groundnut and cotton and area stabilizing policies in sugarcane, jute and potatoes to stabilize production.

Bandopadhyay (1989) in his study found that during the period 1950-51 to 1984-85, the increase in growth rate in the districts in West Bengal was generally associated with instability in the production of rice. Such instability was significantly higher in the post Green Revolution period. In the same study, he found that for Punjab-Haryana, growth rate in production of wheat was higher in the pre Green Revolution as compared to the post Green Revolution period. However, there were definite signs of diminishing year-to-
year fluctuation in the wheat production with adequate irrigation facilities particularly in the districts Punjab.

Mitra (1990) examined the growth and variation of agricultural production in Maharastra for the period 1956-57 through 1984-85 found that crop production at the state level as well as different regional level’s particularly in case of food grains, remained more stagnant till around early 70’s. It then picked up and continued showing an increasing trend until the beginning of 80’s and, thereafter it again showed a decreasing trend till mid 80’s. The study also showed that higher growth rates are associated with higher levels of instability in crop production. The study concluded that development of irrigation and associated new technology had not been effective in reducing the overall instability in the agricultural of the state and in the different regions of the state, especially in the case of food grains.

Kaushik (1993) examined the pattern of growth and variation of crop output in India in general and oilseeds in particular for the period 1968-69 to 1991-92. The study revealed that growth in food grains output was due to increase in productivity. However, for oilseeds the growth was due to the growth in area for the period 1968-69 to 1979-80. However, after 1980, its growth was also due to improvement in productivity. The study also concluded that fluctuations in yield would have to be controlled to bring about stability in output, as it was the major cause for the fluctuation in the output.

Mander and sharma (1995) made a comparative study of the performance of cereal crops in different states of India in the Post-Green Revolution period 1966-67 to 1988-89. The study revealed that during this period the production of major cereal crops namely wheat, rice and maize
increased significantly registering a growth rate of 5.96% for wheat, 2.85% for rice and 1.09% for maize. The major portion of increased production had come from the increased productivity. However, the progress showed by different crops in different states had not been uniform. Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Gujarat and Maharashtra were the major producers of wheat crops, producing nearly 97% of country’s total production and constituting 95% of the country’s area under the crop. In Assam production of wheat increased at the rate of 16.99% during the period, which was very small as compared to the county’s production. However, in case of rice, Assam was one of the major rice producing states, where production of rice increased the rate of 1.47%.

Sawant and Achuthan (1995) in a study analyzed agricultural growth across crops and regions of India and came to the conclusion that during the period from 1967-68 to 1992-93 (post Green Revolution period), there had been a significant acceleration in the agricultural production which could not be attributed merely to a favorable weather. The role played by yield improvement in including higher output growth had been for more than that of expansion in area, indicating that process of growth had been technologically more dynamic too. It was also noticed that there had been an increasing shift of land from food grains to non-food grains in the latter part of the green revolution. Yet another distinguishing feature of agricultural scenario in the 1980s is that, with the wider dispersal of growth across crops and regions, agricultural growth has become more board-based in recent years.

Raghavan (1995), analyzed the trend rate of growth of crop since independence and concluded that wheat crop in India had exhibited a robust
growth for a considerably long period from the 1950’s through two decades of the green revolution. This miraculous performance could be sustained because of an enclave based growth strategy that was pursued since the mid 60’s, the main thrust of which included making available to the farmers in these enclaves of subsidized input-cum technology package, free access to marketing and storage of output and a tax free ‘cost plus’ price. It was noticed that after 1984-85, the production of wheat had started too declined. Therefore, if the wheat crop has to regain its earlier trend, the existing strategy has to be remodeled and targeted towards the weaker farm households, preferably outside the already saturated enclaves.

Singh, Baghel and Gupta (1997) examined the variability of food grains production and its growth rate change in India for the period 1949-50 to 1994-95. They found that during this period area under food grains had increased by 25 percent. Among the years, Kharif crops dominated the cropping scenario, which covered more than 60 percent. However, the productivity of Rabi crops was found higher than that of Kharif crops. The study also revealed that fluctuation in production was due to variation in yield performance. The same scenario of agricultural output for the state of Madhya Pradesh had been observed in the studies of et al (1996) and Pendse et al (1996)

Bhalla and Hazell (1997) attempted to project feed and food demand for India to 2020 under alternative income growth scenario. With the rise in per capita income, direct demand for food grains may not increase as rapidly as earlier, but the derived demand for food grains for feed increases and therefore the total pulses during the period under study. Since the climatic conditions of Assam were quite congenial for the cultivation of pulses, there
was an urgent need to increase productivity of pulses through adoption of modern technology, changing cropping pattern and improved crop management practices.

Rawal and Swaminathan (1998) studied the agricultural growth in West Bengal for 45 years (1950-1996) came to the conclusion that from a path of low growth during the first three decades of this period, in the 1980’s agriculture moved to a path of high growth. They viewed that that such acceleration in growth occurred during and after major changes in agrarian institutions and land relations. This indicates the importance of changes in agrarian structure and agrarian reform for economic growth in a backward agrarian economy.

Kurosaki (1999) made a comparative study of the performance of agriculture in India and Pakistan, during the 20th century (1900-1995), on the basis of data that corresponds to the current border. He showed that the growth performance of agriculture in India and Pakistan was a stagnant one in the colonial period. After 1947 sustained improvement occurred in both countries although the performance was better in India than in Pakistan in per capita food production. However, the absolute level of this achievement in terms of per acre productivity and per capita production is not high compared with the international standard.

Ahmed (1999) reviewed the progress of food grains production and productivity in India during the post independence period and found that food grain production had gone up from 52 million tonnes in 1947 to about 192 million tonnes in 1995-96. Though since independence, growth and development of Indian agriculture was remarkable and its production and productivity increased sufficiently, it was far behind when we compare
country’s productivity with that of developed countries of the world. Therefore, a lot of efforts are needed for raising the production and productivity of Indian agriculture.

In Assam little works have been done so far on agricultural sector. Mr. Goswami (1963) first attempted to study various aspects of agriculture in Assam. Mahanta and Neog (1968) analyzed the different aspects of agriculture and animal husbandry in Assam.

Das (1978) examined the growth rates and nature and extends of instability both for food grains and total agricultural production in state of Assam, Bihar, Orissa and West Bengal for the period 1950-51 to 1973-74. He found that during the period, the growth rate of agricultural production was falling over time in Bihar, while the growth rate in Assam, Orissa and West Bengal remained constant. The study also revealed that there was increasing instability in the production of food grains in the state of Assam, Bihar and Orissa. While food grains production remain stable in West Bengal, despite the fact that all these states had experienced positive growth rates of 1.75 %, 3.33%, 2.37% and 2.93% respectively during the period.

Ahmed and Bhowmick (1991), in a study examined the nature of price, productivity and acreage response of some important crops in Assam for the period 1971-72 through 1986-87. The study concluded that acreage under principal crops in Assam is influenced mainly by the yield of crop, lag acreage and area under irrigation. Productivity was noted to be lower than the all India average. Moreover, farmers in this region were not price responsive. Therefore they laid emphasis on the use of improved seeds and post harvest technology in the cultivation of all the crops in the state.

Kalita and Baruah (1991) studied the growth and instability of three types of rice namely autumn rice, winter rice and summer rice for the state of Assam for the period 1951-52 to 1988-89. The study concluded that only in case summer rice, the growth rate was sizeable but instability had been found to the largest. Winter rice was found to be the most stable crop in the case of productivity. The growth rate in area and production of autumn and winter rice were found to be negligible due to slow development of irrigation facilities, gradual degradation of the nutrients status of the soil in state and increasing damage of standing crops by flood.

Barthakur and Bhattacharya (1999) had done a similar type of study for rice in Assam. The study concluded that there had been an increasing trend of production of rice in the state. But the growth rate of production had significantly declined during the post-green revolution period, indicating that Green Revolution was lacking in the state of Assam. To increase productivity, the study suggested adoption of improved technology, intensive use of existing resources and better extension services.

The discussion on agricultural development is not complete unless we throw light on the factors that influence the growth and stability of
agricultural production. Very few empirical studies were undertaken in the past to identify the factors explaining for slow growth and inter-temporal and inter-regional variation in agricultural growth. We now turn to make a summary of the factors responsible for slow growth and instability in Indian agriculture in view of the past studies.

Sharma (1964) was of the opinion that the agricultural development should be assessed not only by the trends in the agricultural production and productivity but also on various physical inputs like labour (human and animal), irrigation, fertilizer, improved seeds, extent of cultivated area etc.

Narain (1977) had analyzed that there are two types of explanatory variables contributing towards increase in productivity in Indian agriculture. According to him, the non price factors particularly, the growth of irrigation facilities, increased use of fertilizer and high yielding varieties of seeds had contributed towards the increase in yields of individual crop in different states.

Das (1978) in his study concluded that increasing instability in agricultural production particularly food grains production may be on precarious rainfall, extension of area under cultivation of inferior crops, use of fertilizer, inadequacy of irrigation facilities, absence of better farming methods etc.

Joshi and Haque (1980) estimated the relative role of technological, institutional and climatic factors in the determination of temporal growth and interregional disparities in India. They concluded that fertilizer consumption and area under HYV seeds were the important determinants of agricultural growth in a majority of Indian states. Next in order were time (indicating technical change) irrigation, rainfall and credit.
Bhatia (1980) showed that more investment on irrigation and greater extension efforts would have to be made for higher use of fertilizer and HYV seeds in backward states for balanced growth of agriculture in different states. More research efforts would also have to be made for accelerating the growth of productivity of pulse and making the sectoral balances in food grains.

Mehra (1981) highlighted the association between increase in yield variability and the use of high yielding varieties (HYV) and larger application of fertilizer per unit of land. Obviously, the area and yield variability result in the variability in agricultural production. The magnitude of variability had grown with the growth in agricultural production.

Barman (1985) mentioned that the backwardness of Indian agriculture is primarily due to institutional, technological and organizational constraints and the intensity of each of the constraints varies from region to region depending on localities, geographical environment, fertility of soil, rainfall, climate, weather, rural infrastructure etc.

Tamhane (1987) believed that the principal cause for low productivity in Indian agriculture was the deterioration of soil fertility owing to erosion and other natural calamities like flood hazards in some areas and drought conditions in other.

Prasad (1998) mentioned that for accelerating growth of food grains production in the coming decade, a multi pronged strategy would be needed with a focus on augmentation of water resources and evolution of improved varieties of seeds for rain fed as well as flood prone areas. This would need to be supplementation by adequate availability of fertilizer, pest management and a regime of incentive prices and timely supply of credit etc.
Singh & Singh (1999) made a comparative study of agricultural development performance of the state of Punjab and Bihar to analyze the factors responsible for imbalances in agricultural development. They concluded that poor land resource distribution, low irrigation potential, low application of fertilizer, low coverage of HYV seeds, and lack of proper infrastructural facilities contributed low agricultural progress in the state of Bihar as compared to Punjab. The analysis suggested that for the development of Bihar there was urgent need to concentrate on the use of fertilizer, high coverage under high yielding varieties, more use of electricity per hectare and increasing the area under irrigation and increase the credit availability.

Bhatia (1999) examined the relationship between infrastructure development and growth in agriculture concluded that there was significant scope for increasing the yield of food grains and agricultural income by improving the rural infrastructure.

From the above overview of literature, the following broad observations can be made on the constraints and prospects of agricultural production and productivity in Assam.

- The agricultural production mainly depends on two factors:
  
  (i) Availability of arable land and,
  
  (ii) Productivity per unit of land.

As the supply of land is fixed, productivity of land has to be improved in order to increase agricultural production. Thus, productivity of land has to be increased in order augment agricultural output in the country for the coming decades.
• Productivity per unit of land can be increased with the best and efficient utilization of inputs like labour, water, fertilizer etc. applied to it.

• Agricultural productivity can also be increased by changing the pattern of production towards more intensive system of cultivation or by progressively changing cropping pattern from low value crops to high value crops.

• The Green Revolution had an appreciable effect on the agricultural production in India since 1969-70. But the effects of new technology on agricultural output of different varieties of crops are different in different regions.

• For balanced growth of agriculture in different states of the country, there is urgent need to concentrate on the use of fertilizer, high coverage under high yielding varieties, more investment on irrigation and greater extension efforts and increase the credit availability in the agriculturally backward states.

• Production variability is an inevitable consequence of rapid agricultural growth. For India, the post Green Revolution period showed a higher degree of production variability in a number of states. Further, variability was higher for food grains than other crops.

• Increased variability in agricultural production particularly food grains productions may be explained by factors such as dependence of agriculture on precarious rainfall, extension of area under cultivation of inferior crops, inadequacy of irrigation facilities, absence of better farming methods etc.

• Although since independence, growth and development of Indian agriculture were remarkable and its production and productivity
increased sufficiently, it was far behind when we compare country’s productivity with that of developed countries of the world. Therefore the country will have to make extraordinary efforts by way of investment in irrigation, rural electrification, scientific research and extension and other rural infrastructure for raising its production and productivity in agriculture in general and food grains in particular, in order to meet the demand of its fast growing population.

1.9. LIMITATIONS OF THE STUDY

As mentioned above, a few studies which are available on agricultural sector in the north-eastern region of India based on macro and micro level. In order to get adequate insight to the performance and problems of agricultural sector in the region, it would be necessary to go beyond the overall macro picture presented by aggregate statistics to carry out investigation at the micro level. The present study is an attempt to provide more comprehensive analysis of the agricultural growth and problems in the region by interfacing a macro picture describe by secondary data with the realities at the grass root, observe through a field survey in which farms and households are the units of observation. Since the agricultural sector is the unorganized sector of our economy, no records of year-wise production is maintained by farmers even by large farmers also. The primary analysis of the year-wise productivity of the sector is mostly depended on official or departmental data provided by the agricultural department of the government.

Thus to conclude, agricultural development is the basic precondition of sectoral diversification and development of the states’ economy. An increasing marketable surplus of agricultural output is much essential in a poor state like Assam for increasing supply of food and raw materials at non-inflationary prices, widening domestic market for industrial products
through higher purchasing capacities in the rural sector, facilitating inter-sectoral transfers of capital needed for industrial development along with infrastructural development and increasing foreign exchange earnings through increasing volume of agricultural exports. Besides, agriculture in Assam is frequently affected by natural factors like flood, drought etc. It is necessary to develop different agricultural strategies for flood affected and unaffected areas. The study is very much important in this regard to achieve sustainable development in the sector.

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