SOCIO-ECONOMIC DEVELOPMENT OF AGRICULTURAL PEASANTS OF JORHAT DISTRICT, ASSAM: A GEOGRAPHICAL ANALYSIS

Thesis Submitted to Nagaland University in Fulfilment of the Requirement for the Degree of

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JULY- 2017.

THE THESIS IS DEDICATED TO MY BELOVED PARENTS LATE CHAKRAPANI NATH AND LATE BULUMONI NATH

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CERTIFICATE

This is to certify that the thesis submitted by **Mrs. Sabita Nath** towards the Degree of Doctor of Philosophy (Ph.D) in Geography titled **"Socio-Economic Development of Agricultural Peasants of Jorhat District, Assam: A Geographical Analysis"** is a bona fide study to the best of my knowledge and belief. The study acknowledges duly works of other scholars and sources. I also certify that the thesis has not been submitted to any other University or awarding institutions in India or abroad for the same degree of others.

I, therefore, recommend that subject to fulfilment of other formal requirements, the study may be placed before the examiners for evaluation.

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DECLARATION

I, Sabita Nath, do hereby declare that this thesis entitled **"Socio-Economic Development of Agricultural Peasants of Jorhat District, Assam: A Geographical Analysis"** submitted for the award of the degree of Doctor of Philosophy in Geography comprises the result of my own research work carried out in the Geography department, Nagaland University. The content and basis of this thesis is not an extract or form of the award of any previous degree to me in any manner or to the best of my knowledge to anybody else and the thesis has not been submitted by me for any research degree in any other university.

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CHAPTER I

INTRODUCTION

ADMINISTRATIVE MAP OF JORHAT DISTRICT

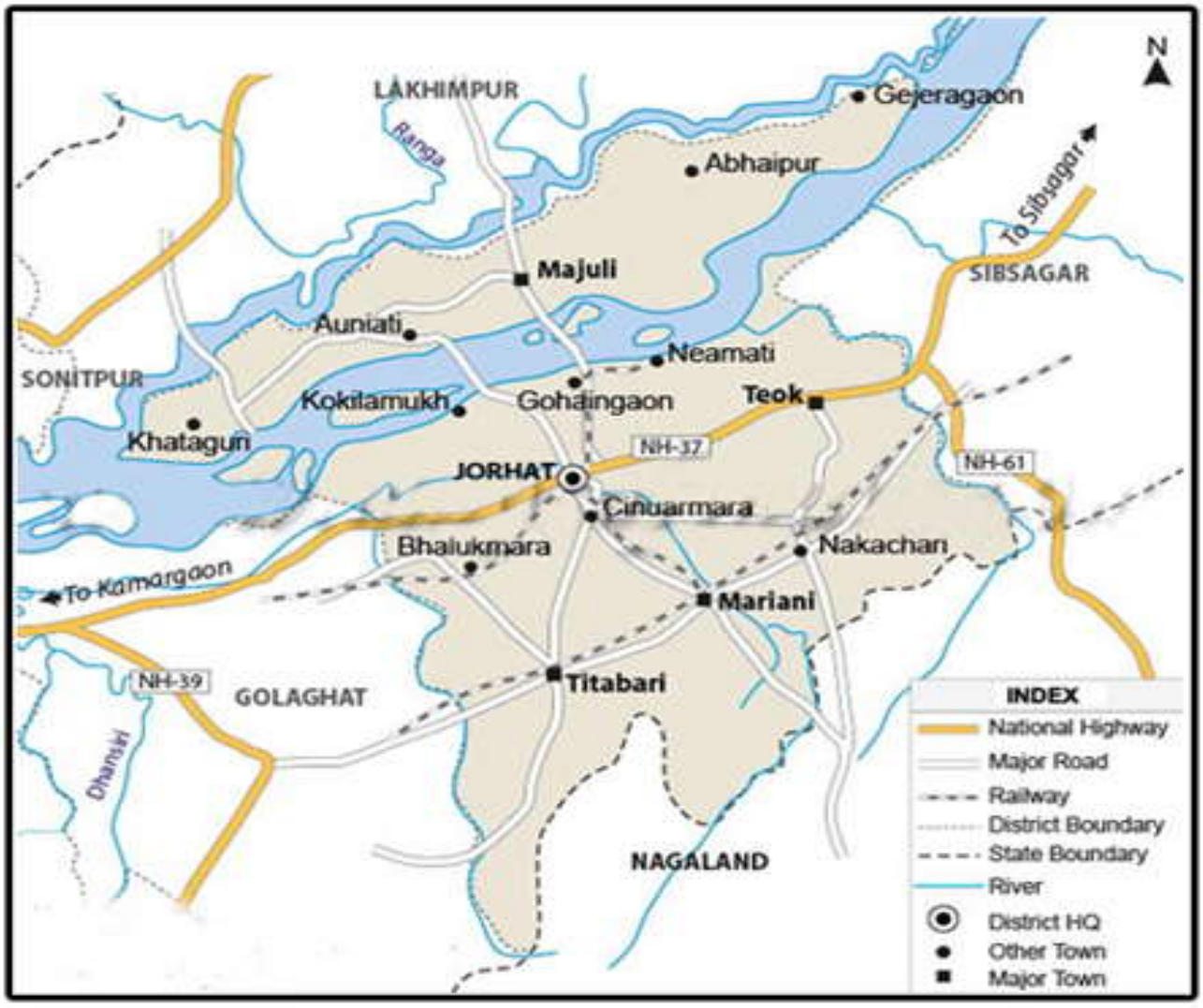

FIG 1.1

1.1 INTRODUCTION

Agriculture is the backbone of Indian economy. In India around 70 percent of the people earn their livelihood from agriculture. It fulfils the basic need of human beings and animals. It is also the most extensive form of human occupation where half of the world's population earns its livelihood. The word "Agriculture" comes from a Latin term "Agercultura" which has its origin in the words "ager" means a field and "cultura" means to culture or cultivate. That means the word agriculture is the science or the art or the practice of large-scale soil cultivation in order to produce crops. The etymological meaning of the phrase "agricultural geography" is the description of the art of large- scale soil cultivation with reference to natural environment and human circumstances.[1] Thus agricultural geography, dealing with the spatial organisation of crops and their concentration, provides an interesting field in which geographers can play a vital role for well being of the society.

A peasant is a member of a traditional class of farmers either labours or owners of small farms, especially in the middle ages under feudalism, or more generally, in the pre-industrial society.[2] Peasant either hold little to land in fee simple or hold land by any of several form of land tenure among them socage, quit rent, leasehold and copy hold.[3] Peasants typically made up the majority of the agricultural labour force in a pre industrial society. The majority of the people in the middle age were peasants. The term peasant proprietors were frequently used to describe the traditional rural population in countries where small holders formed much of the land.[4] More generally the word 'peasant' is sometimes used to refer to poor or land less farmers and agricultural workers especially in the poorer countries of the world in which the agricultural labour force make up a large percentage of the population. The implication of the term is that the 'peasant' is uneducated, ignorant, and unfamiliar with the more sophisticated mannerisms of the urban population.

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[1] Singh J. & Dhillon S.S., *Agricultural Geography*, Tata McGrow Hill Publishing Company Limited, New Delhi.
[2] Peasant, def. A.1.a.n. OED online, March 2012, Oxford University Press, 28 May 2012.
[3] Merrian – Webster online "Peasant".
[4] Hutton W. (2004), *Early European History*, Kessinger Publishing, p. 440.

Peasant farming describes small scale farming for subsistence as well as for cash sale in the market. Initially, in different parts of the world, small farmers produced crops for domestic use as well as for sale in the market. However, after 1860, these farmers began to export their crops.[5]

On characteristics of undeveloped agricultural peasants is self-sufficiency. Farm families in those circumstances consume a substantial part of what they produce. While some of their output may be sold in the market, their total production is generally not much larger than what is needed for the maintenance of the family. Not only is productivity per worker is low under these conditions but yields per unit of land are also low. Even where the land was originally fertile, the fertility is likely to have been depleted by decades of continuous cropping. The available manures are not sufficient and the farmers cannot afford to purchase them elsewhere.

The sufficient socio-economic development of agricultural peasants inevitably entails effort to raise productivity in the agricultural sector so that not only a small working force can produce enough food for the rest of the society, but also to release a big chunk of its working hands to join the industrial sector. Thus raising agricultural productivity forms one of the most important tasks of most of the developing countries aiming at a quicker pace of socio-economic development. In India, efforts have been made to raise agricultural productivity by raising more and more land under cultivation in its early decades of planned development. However, it is soon realized that emphasis has to be laid more on productivity than production. All out efforts were made to increase productivity of land by way of introducing improved varieties of seeds, mechanization and other modernized method of cultivations popularly known as "Green Revolution" in the history of post independent India by the late sixties.[6] But it was seen that the effects of Green Revolution were highly localised and in the large parts of the country, its impact was minimal.

Agriculture is the most dominant sector of the Indian economy and crop production occupies the most important part of the agriculture. However, the

[5] Op. Cit.
[6] Hussain M., *Systematic Agricultural Geography*, Rawat Publication, New Delhi.

agricultural sector was most neglected during the colonial rule and immediately after the independence food became the prime concern of the National Government and it became most necessary to pay attention to increase food production on a priority basis to feed the ever-growing population of the country.

It is true that one cannot expect a uniform pattern of socio-economic development of agricultural peasants in a country like India, with wide variation in natural, economic, cultural and historical conditions. But the objectives of Agricultural Planning failed to achieve the balanced regional growth among the agricultural peasants, as a result of which, a wide interstate differences of growth of agricultural production was noticed. The growth of agricultural peasants was highly localized in some areas of the country. States like Punjab, Gujarat, Tamil Nadu and Haryana has much higher rate of growth than most of the other states of the country.

The socio-economic development of agricultural peasants without structural changes is a difficult task. This difficulty is more pronounced in countries with high population growth and high pressure of population on land. All these have contributed to a regional disparity or regional imbalances in the rate of growth of crop output and productivity. This aspect has drawn the attention of both the agricultural planners and scholars and it is now accepted that the various national level plans and programmes would be limping without proper location of specific schemes and plans on the basis of agricultural regions. Macro-economic magnitudes and approaches do not give deeper insight into the problems of agricultural development in India and, therefore, planning should be extended to lower level units, i.e., agro-climatic and agro-economic zones.[7]

Jorhat district of Assam has a strong agro-climatic base, yet its economy in general and agricultural in particular is not showing satisfactory performances. As a result, a low level progress in the primary sector of this region has resulted and many socio-economic problems are being cropped up. Agriculture is the principal source of livelihood for a majority of the people in the rural areas of Jorhat district.

The agricultural sector is so important to the state's total economy that it alone has contributed 38 per cent to the state's total income in 1990-91. The agricultural productivity index for Assam was 156 in 1989-90 as compared to 183 for

[7] Ibid.

India.[8] Agriculture has another most important role to play. It acts as the main absorber of the working population as it engages as high as 70 per cent of the total working population in the state. In fact, the average yield of cereal and non-cereal crops in Assam is much lower compared to that of other states, the technology deployed in agriculture is traditional and diffusion of innovations is insignificant. Although Assam ranks seventh out of the twenty-eight states in India in terms of per hectare productivity, it is not an impressive record considering the potentiality of its arable land and natural endowment. Jorhat district has very low agricultural productivity per hectare of land. It is obvious that the socio-economic development of agricultural peasants' potential of the district is highly under-utilized and much remains to be done.

1.2 REVIEW OF LITERATURE

The relevant literature on different aspects of agricultural resource utilization, farm size and productivity and farming system are sought to be discussed in brief. Different researchers have tried to show the possibilities of increasing agricultural output by judicial adjustment of one optimum allocation of scarce farm resources. Farm management survey report published in the mid fifties has diverted the attention of agricultural geographers in India towards the studies on the size related productivity in agriculture. Such studies assume special importance under various farming condition in our country, as well as other part of the world. Like land use pattern with respect to farm size and productivity, farm size and tenancy have also been a long debated issue in the present economy. In the context of socio-economic development of agricultural peasants in our country and abroad, a few number of studies relating to farm size-tenancy and productivity provided contradictory results leading to different policy implications. Whatever literatures that are available and pertinent to the present study are reviewed under the following sections:

1.Land use pattern with respect to farm size and inputs variables.

2. Farm size- productivity relationship.

3. Farming system analysis.

[8] Dhar. P.K.,(1994), Axomor Arthanitir Ruprekha (The Economy of Assam), Kalyani Publisher, Ludhiana.

1.2.1. LAND USE PATTERN WITH RESPECT TO FARM SIZE AND INPUTS VARIABLE

Shrivastava (1966) investigated the pattern of employment in Agriculture in Ranchi District of Bihar. He considered the total volume of available labour days of both male and female members. Female workers participated invariably with their male counterparts. He observed that 80.1 per cent of total family labour days were utilized in farm work. He further observed that smaller was the size of farm, the greater was the intensity of human labour utilization.

Welliyz et al. (1970) reported that within the constraints of technology and managerial skill, both small and large farms were reasonably efficient in resource use.

Government of West Bengal (1972) Agricultural Department conducted a study and observed that it was not merely the right on land that was important for adoption of improved practice, but the extent to which the farmer depends on agriculture as his means of livelihood definitely had bearing on his adoption behaviour. Thus it was found that even amongst the purely share farmers, the same number of persons who held agriculture is main occupation were also adopter of chemical fertilizer.

Motilal (1973) made an investigation in five community development blocks of Delhi to examine the economics of tractor utilization. He reported that hired labour employment per hectare was found increasing with the increase in farm size.

Goswami and Bora (1974) in their study of economics of farm Management in Nowgaon district of Assam reported that the number of full time farm workers per farm increased with the increase of farm size. The average annual employment for and adult male family worker was 293.29 man days, out of which 42 per cent engaged in crop production.

Patgiri (1974) studied the crop production and land use pattern in Jorhat North East block of Assam. He observed that out of the total number of man days utilized on sample farms, the per cent share of small, medium and large size classes were 21.52, 34.79 and 43.69 respectively. Per farm and per hectare average human labour use was 471 and 175 man days respectively. The use of human labour per

hectare was highest in small size class being 208 man days and lowest in large size class, 51 man days. The average man days employed per farm for small, medium and large holdings were 304, 391 and 617 man days respectively.

Kahlon and Miglani (1974) in a study on the Farm Management in Ferozpur District (Punjab) reported that family labour utilization per hectare of cultivated area showed a decreasing tendency with the increase in farm size. Thus, family labour utilization had an inverse relationship with the size of farm.

Kalita (1975) studied the cropping pattern in flood affected and flood free areas in Bhawanipur Block of Kamrup District and found that the family labour utilization per farm was 440.20 man days. On per hectare basis it was 114.91 and 197.90 man days for gross cropped area and net sown areas, respectively. He further reported that family labour utilization per hectare of gross cropped area decreased with the increase in size class of the farm. In flood affected areas per hectare utilization of hired labour for gross cropped and net sown area was 23.84 man days each, respectively. In flood free areas, the hired labour utilization per hectare of gross cropped and net sown areas were 21.67 and 37.31 man days respectively.

Mishra et al. (1976) studied resource use and farm productivity in Kalyanpur Block of Kanpur. They found that the average family labour utilization in small, medium and large farms were 130.58, 89.04 and 68.08 man days per hectare respectively. Family labour utilization, thus, showed a negative relationship with the farm size.

Dhawan and Bansal (1977) studied the rationality in the use of various resources in Punjab family and observed that small, medium and large farms used the land resources efficiently. Small farms used excessive amount of human labour but a comparatively lower amount of seeds, fertilizer and manures comparing to other sizes of farm. The medium and large farms were rational in making expenditure in almost all resources. They indicated that there was better scope of increasing intensity of cropping both in medium and large farms.

Garg (1977) in a study in two villages of Kalyanpur Block in Kanpur District of Uttar Pradesh, examined the farm investment, farm productivity, farm income and labour employment patterns. They reported that the average investment of fixed capital per farm with and without land showed an increasing trend with the increase in farm size. The intensity of cropping also varied directly with the farm size. The per hectare utilization of human labour, manure, fertilizer and irrigation in physical and money terms increased with the increase in farm size.

Asaduzzaman (1979) in his study regarding the adoption of HYV rice in Bangladesh reported that the extent of adoption of HYV paddy was directly related to the farm size. The larger farmers showed greater positive attitude towards the HYV paddy owing to their favourable socio-economic status.

Mandal (1980) reported from his study that share cropping tenancy without cost sharing was found to be inefficient in land use and productivity, but cost sharing tenancy had some favourable impact towards improving productivity on share cropped land through the use of required resources.

Mishra (1981) conducted a study in Badasahi Block in Orissa state. He observed no definite relationship between cropping intensity and farm size. The availability of human labour, bullock labour and farm yard manure per farm increased with the increase in farm size. However, on per acre basis, they are found to decrease with farm size. Further it was revealed from the study that per acre use of bullock labour and manure had an inverse relationship with holding size while per farm utilization had a direct relationship with the farm size.

Byrness (1981) observed in his study that the rate of adoption of higher technology in agriculture production is comparatively higher in larger farm sizes in comparison to smaller sizes in developing countries.

Itharat (1981) in his analysis of socio-economic characteristics of the farmers in the North Eastern Region of Thailand reported that the rate of adoption of higher technology especially in terms of material inputs is directly related to the size of the farm.

Suminteredja (1981) reported that higher level of adoption of recommended practices of paddy production is associated with higher average size of farm. Inputs related to the new technology were found used intensively by large farm sizes than others in Indonesia.

Rai et al. (1981) discussed the renting agricultural land based on the data collected from a selected sample of 149 farmers in 45 villages from 15 tahsils in Haryana. The clusters of villages were divided into three groups with canal irrigation facilities; tube well, irrigation and no source of irrigation. Of the selected farmers, 46 had holdings less than 10 acres and 103 had more than 10 acres. In general, small farmers rented in land and the practice of renting in land was decreasing over time. The crop sharing system was more common in canal irrigated areas compared to tube well irrigated areas. In both canal and tube well irrigated area crop share renting was a better proposition than cash renting. As examination of the adoption of improved practices and mode of ownership were suggested that improved practices were used more under self cultivation than on rented lands.

Bhalerao et al. (1983) studied the dfficiency of land use in vegetable production in Kashi Vidyapith block of Varanashi. The study indicated the ration of marginal value productivity (MVP) to marginal cost (MC) using Cobb-douglas production function for cost data collected from 150 vegetable growers. The author observed that impact of land was positive and significant for small farms and negative and non significant for large farms.

Salik (1983) conducted a comparative study of cost and return of modern and traditional varieties of rice in Chanduali Block of Ranchi district, Bihar. The study indicated that the yield per hectare of rice decreased with the increase of farm size for both modern and traditional rice varieties. Human labour productivity was inversely related with farm size. He reported a higher bullock labour productivity which however did not show any relationship with farm size.

Adjyoga (1986) performed a study on input-output data obtained from a random sample of potato farms in West Java. The major objective of the study was to analyze the input allocation for potato farms in the area with respect to 7 input

categories such as land, seed, hired labour, family labour, fertilizer, manure and pesticide. Tenurial status was included in the production function model as a qualitative factor. It was hypothesized that farm inputs were not used efficiency and that potato production was influenced by land tenure status. The result of a Cobb-Douglas production function approach indicated that the present method of production could not ensure optimum combination of input use. Seed, hired labour, family labour, fertilizer and pesticide must be reduced of more profitable farm operation. Land tenure status did not influence potato production. No significant difference was found in intensity of input use between owner operator and rent operator.

Ere (1986) made an analysis of land holdings pattern in Zaria villages in Nigeria and reported that size of the family, age and status of the farmers were positively related to the size of the farmer's holdings. The general smallness in holdings can largely be explained by the underdeveloped nature of the productive forces, particularly the limitations posed by lack of technological support facilities in the rural sector.

Islam and Banerjee (1987) analyzed land availability and patterns of utilization under different tenurial classes in West Bengal. Three hundred sample farms from 10 villages of Burdhawan district were examined during the agricultural year 1982/83. The different tenurial classes considered were (1) Owner occupies; (2) Owner cum tenant farmers cultivating some amount of leased in land along with all or part of their own land, (3) Tenant farmers. They observed that there were no significant differences in cropping pattern between different tenurial groups. Land use and land productivity did however, vary between classes. Pure owner farmers, compared to the other groups, used their land more optimally. Ownership had a great influence on land use and productivity.

Murallidharan (1987) conducted a study in the Kol land of Trichur district of Kerela, which consisted predominantly small and medium size operational holdings. Because of effective implementation of land reforms in rice production sector, tenancy did not exist in the study area. Rice was cultivated in the study area as

summer crop and therefore is normally irrigated. The author found that the adoption of modern technology which is manifested by the use of high yielding varieties of seed, fertilizer, pesticides etc., was generally high in all size groups of farms in Kole district.

Shahabuddin and Fenny (1987) conducted a study on resource allocation behaviour of peasant farmers considering the farmers as owner cultivators, owner-cum share croppers and pure share croppers. He observed that both the risk effect and incentive effect influenced the resource allocation decisions in all categories of farms. Comparisons were made amongst the three classes of farmers in terms of relative intensity of land use and found that, share croppers used land more intensively than other two categories of farms.

Bahadur et al. (1988) in their study in two areas of Andhra Pradesh reported that cattle labour had influenced the output in all size groups including overall size of farm. They observed that production elasticity of human labour, cattle labour, manures and fertilizers had turned to be significant on small farms and human and cattle labour were significant on small farms and human and cattle labour were significant on medium farm. For large farms and an overall farm size production elasticity of cattle labour, manures and fertilizers were significant. Thus it is evident that cattle labour had its influence on production, irrespective of far size. They found increasing factor returns for cattle labour of different magnitude in small farms in case of medium farms, the production elasticity for cattle labour was negative and also significant which indicate excessive use of cattle labour on medium size group. Use of human labour was excessive in small farms, since the production elasticity was found negative but significant. Only in medium farms, the human labour was used in optimal efficiency. It was observed during the conduct of the study that majority of farms had not gone up to the recommended dose of fertilizers except some farmers in large sized farms. They also observed the ignorance of the part of the farmers of all sizes of farms in respect of use of right quantity of resources at right time.

Khan and Alam (1988) made a comparative study on net returns of tenants operated and owner operated farms. In the study, they observed differences in input

structure. In terms of percentage, the single largest cost item was human labour, on both types of farms followed by rental value of land and bullock labour. They also observed that in case of tenants, the proportion of input on seed, human labour and manures was higher i.e. 43.01 per cent corresponding to 39.24 per cent on owner operated farms. The proportion of fertilizer and bullock labour were higher in case of owner cultivated farms (19.83 per cent) compared to the other category (16.89 per cent). Further, they indicated that the proportion of the value of manures to the total cost was higher in case of tenant operated farms, but in case of fertilizer it was higher in owner operated farms than tenant farms. In regards to the relative efficiency of resources use, it was found that MVP of land, labour, fixed capital, variable capital were higher in owner operated farms. It was found that, except land all other inputs were more efficiently used on owner cultivated farms.

Parikh (1988) conducted a study to examine the structural differences in the behaviour of small and large farmers based on the data for 461 farms in 16 villages in Bangladesh, collected during 1982. He observed that statistical tests supported the hypothesis that share croppers and owners have significantly different in yield and fertilizer consumption behaviour. However, similarities were revealed in yield and fertilizer consumption across small, medium and large sized farms.

Singh et al. (1988) conducted a study on energy use pattern of cereal crops on different sizes of farms in Deoriah district in Eastern U.P. They considered per hectare energy input in its various forms such as human, bullock, tractor and machinery along with its operational distribution for paddy. They found that the total energy use from various sources was maximum on large farms, followed by small, medium and marginal farms. Bullock energy use decreased with the increase in size of the farm, while utilization of tractor energy increased with the increase in farm size.

Dubey and Sen (1988) in their study in Chiraigaon block of Varanasi district of Eastern U.P. examined the structure and use of farm assets of different sizes of farm. The average size of holding was found to be 0.48 hectare for marginal farmers whereas for small and large farmers it was 1.48 and 3.75 hectare respectively. Intensity of cropping was 188.96, 167.64 and 137.28 per cent on marginal, small and

large farm respectively. They found that marginal farms employee done an average 77 man days per year whereas small and large farms, 181 and 342 man days per annum respectively. Income generated from cropping activities on marginal farm was Rs. 1306.60 per annum, whereas on small and large farms it was Rs. 3,341.34 and Rs. 6,423.85 per annum respectively.

Sengupta and Giri (1989) in their study in the district of Nadia in West Bengal, showed that fixed rent tenancy encouraged improved use of inputs and greater yield than variable share renting for both aman and boro paddy. It was also indicated that input use pattern and yields in the cultivated leased. In shared with fixed renting was similar to those of owner cultivated land.

Islam et al. (1990) in their study on land tenurial system in some areas of Bangladesh reported that the owner cum share croppers and pure tenants farmers used more labour, 182.03 man days per hectare and 171.86 man days per hectare respectively than pure owner farmers (166.74 man days per hectare) while the pure owner farmers used higher rate of bullock pair days (39.53 days/hectare) than the owner cum share cropper (34.34 days/hectare) and pure tenant farmers (34.02 days per hectare). In case of fertilizer use, the pure owner farmers used a higher dose (311.23 kg./hectare) than owner cum share croppers (212.74 kg./hectare) and pure tenant farmers (234.01 kg./hectare). Input sharing pattern 50:50 and 100:100 sharing arrangement was observed generally between tenant and owner farmers.

Pandurangadu and Raju (1990) conducted a study to examine and to assess the pesticide use pattern by different sizes of farms in cotton cultivation in Guntur district of Andhra Pradesh. In the study, it was found that expenditure on insecticide was highest on large farms. Use of all categories of pesticide was found to be higher on large farms followed by medium and small farms. Higher expenditure on pheromone traps by large farmers clearly implied the awareness of big farmers about these new, low cost effective pests killing technique. It can be said that small farmers have not yet taken advantage of this measure as was evident right from seedling stage up to the stage of plant growth.

Singh and Kaur (1990) shed some light on the trends in the main parameters having a bearing on the structure of Punjab Agriculture. They found that due to intensification of agriculture, cropping intensity has increased sharply from 133 in 1966-67 to 172 per cent in 1987-88. The size distribution of holdings has moved in favour of medium and large farms. The input structure has shifted in favour of modern inputs such as fertilizer, irrigation, implements and machinery in all the sizes of farms, particularly medium and large farms. There had been displacement of draught power specially in medium and large farms. As a result of the aggregate structural change, the per hectare farm business income at constant price increased by 61.2 per cent over 2 decades (3 per cent per annum) despite the much talked about green revolution.

Mukhopadhyay and Pal (1990) examined the role of farm size in influencing innovation adoption for the farm as a whole and per acre of individual crop in Nadia district of West Bengal. The extent of adoption was defined in the study as the aggregate expenditure on key inputs. A sample of 200 farms was randomly selected in 2 blocks of Nadia district, West Bengal. The difference of means test was applied. With the exception of Boro (summer paddy), the level of adoption was not influenced by farm size. The extent of inter farm variation was wider in the case of Aman (winter paddy), Aus (autumn paddy), Jute and all rain fed crops, as compared to irrigated Boro and Wheat.

Sabur and Haque (1992) examined the efficiency of land use by comparing the estimated marginal value products of various inputs and their respective factor costs. The study revealed that the farmers had not been using their available resources efficiently irrespective of farm sizes.

Saikia (1992) examined the pattern of landholding and agricultural production of upper Brahmaputra valley of Assam, reported that the agricultural productivity is increasing with the diminishing rate when the size of landholding is increased. On the other hand the degree of variation among the distribution in the various sizes of holdings increased with the increase of the size of landholdings.

Bordoloi (1993) in his study about the farm mechanization in the Titabor sub-division of Jorhat district of Assam, reported that use of power tillers for own farm work increased with the increase of farm size. On per cropped hectare basis, power tiller was found to have been used more in medium farm followed by large and small farm.

Dutta (1993) made a study regarding the technological advancement need for agricultural mechanization in Jorhat district of Assam and reported that use of fertilizer, power tiller were directly related to the farm size. Regarding the types of fertilizer use he reported that only 3 kinds of chemical fertilizer viz. Urea, D.A.P and M.O.P were used by sample farmers of all farm sizes, of which the quantum of urea was the highest.

Sain and Joshi (1994) reported about the human labour employment scenario on the average farm in Punjab state. The family labour employment had a slight edge on the higher side as compared to the hired labour. In terms of magnitude, family labour employment was 51 per cent against the hired labour is with 49 per cent. Of the total hired labour, the share of permanent hired labour was 14 per cent, while that of casually hired labour 35 per cent. However, the comparison between size groups in respect of employment of human labour revealed a higher magnitude of family labour employment on smaller farms as compared to large. It varied between 72 per cent on small farms and 39 per cent on large farms in the state. In case of hired labour, permanent labour employment varied between 2.29 per cent and 22 per cent on small farms to large farms and casual labour between 26 per cent and 39 per cent in above order. Thus, the family labour share revealed an inverse-relationship with the farm size whereas hired labour share increased directly in the state. Further, a close look on total labour used per hectare across different size groups revealed an intensive use of human labour on smaller farms as compared to large farms. It ranged between 152 days on small farms and 106 days on large farms in the study area. The higher level of wages and non availability of casual labour to the extent required due to the disturbed conditions in the state forced the bigger farmers to mechanize the reaping, threshing operations in a bigger way.

Thakur et al. (1994) conducted a study in the Lahowal Spity district of Himachal Pradesh. Sample farmers were categorized as marginal, small and large according to operational holding size. The study included crops such as potato, wheat and barley. Results showed that input use intensity was very high in case of potato. The return to scale in general was greater than unity for potato and wheat on marginal farms and wheat and barley on small farms showing the scope of increasing productivity of these crops in marginal farms. The large farms were found to have decreasing returns to scale demonstrating the fact that these farms were better managed in terms of input use. The importance of human labour utilization was also found important in marginal and small farms. Marginal value product was found more than unity in case of human labours both in small and marginal farms. Over all human labour was found to be the most crucial input for production of crops on all categories of farms.

Ram and Nandal (1994) conducted an investigation on fertilizer use pattern in Haryana considering 18 districts of the state into three groups such as high, medium and low fertilizer using districts. They revealed that fertilizer use per hectare did not follow any linear trend with farm size. They found highest fertilizer use on medium farms followed by large and small farms respectively. Lowest application of fertilizer on small farms might be due to the low land endowments, inadequate credit facilities, low socio-economic status, risk avering attitude etc.

Rao and Gulati (1994) reported that the rate of adoption of fertilizer use was somewhat lower in small farmers than large farmers, owing mainly to credit constraints in Indian agriculture. it was more pronounced in unirrigated or rain fed areas of the country. Use of family labour was found more in large farm sizes than the comparatively smaller farm sizes.

1.2.2. FARM SIZE-PRODUCTIVITY RELATIONSHIP

Sen (1964) studied the relationship between farm size and productivity and found that smaller farms were characterized by peasant family cultivation and larger farms by capitalist cultivation. The study showed that cultivation was carried up to the point where marginal product of labour was zero in smaller farms, while in the

large farms cultivation stopped at the point where marginal product of labour coincided with market wage rate.

Khusro (1964) made a study of farm size and productivity relationship in two ways based on FMG data of some states of India. For his study he considered land revenue as an important factor which may reflect fertility of land. He observed that the land revenue was following decreasing trend with the increase in farm size. For analysing size efficiency relationship he considered two sets of data corrected and uncorrected data of field management study. Correlated data he obtained in terms of acreage in such a way that mean acreage of each farm size group was multiplied by an index of efficiency based on land revenue per acre, called land revenue index. Based on the two types of data the author summed up the generalization about Indian farming system.

Krishna (1964) in his study in two districts of Punjab observed a slight tendency of the output per acre to fall as the farm size increased. But output per man day seemed to increase with farm size when it was measured by acreage and to increase to certain level and then decrease as size was being measured by output. He also indicated that there was no existence of any strong average product or average cost relationship. But considering the direction of change of productivity and cost as size increased there was some indication that the production of land declined with size.

Rudra (1968) by an unorthodox departure from linear regression method, using relatively simple tests on disaggregated data found that correlation between yield and farm size was spurious. Two variables he asserted vary independently of each other. So he reported that there occurred wide variation in farm size and yield. In some cases the yield per acre increased with the increase of farm size. But in some cases there were violent ups and downs of yield per acre with farm size revealing no systematic pattern of relationship. Neither case moved the hypothesis of yield per acre decreasing as farm size increased.

Saini (1969) investigated the land use efficiency in Agriculture in Uttar Pradesh and Punjab. The author observed that coefficients of land and labour were

positive and statistically significant in all estimated equations. He found negative marginal value product for manures and fertilizers due to excessive rainfall during the period. Marginal value product for land showed an inverse relationship with size of the farm.

Lau and Yotopoulos (1971) reported that given fixed factors and input output prices, small farms had higher economic efficiency than large farms. Similar results were also observed by Yotopoulos and Lau (1973).

Rani (1972) studied the relationship between size of farm and yield per acre based on the individual holding data from Farm Management Survey (IADP district namely Pali in Rajasthan, West Godavari in Andhra Pradesh, Sambalpur in Orissa, Raipur in Madhya Pradesh and Alleppey in Kerala). The author opined that the controversy of relationship between the size of farm and yield per acre was based on the aggregated data from some other sources, but the results were not put to statistical tests. The author indicated that whatever be the situation in early sixties, when the F.M.S were conducted, the controversy lost much of its importance in view of the developments took place in Indian Agricultural sector after mid sixties. Even if the small farmers had certain advantages over large farmers in labour intensive technique, there are likely to be wiped out by capital intensive techniques that gained popularity amongst the farmers.

Patnaik (1972) conducted a study on the economics of farm size and scale of production. The author observed positive relationship between yield per acre and size of farms up to 20 acres. The per acre yield of the farm size above 25 acres indicated inverse relationship with the size of the farms.

Singh and Patel (1973) made an investigation regarding the farm size and productivity of Meerut district of U.P. using production function techniques and found that the sum of the elasticity was positive and significantly greater than unity indicating increasing returns to scale. They reported that the total output of the farm increased significantly with increase in the size of the farm.

Singh (1975) investigated the resource use farm size and returns to scale in backward agriculture in Eastern Uttar Pradesh. The author observed constant returns to scale. High magnitude of elasticity coefficient of land was found for the small farms than that for large farms. The production coefficient of labour was highly significant for the large farms whereas it was non-significant for the small farms.

Khan (1977) in his study attempted to test hypothesis, that there was an inverse relationship between land productivity and farm size and that there was no economics of scale in agricultural production. The test was performed by regression analysis on farm level data. The hypothesis about the returns to scale was confirmed but the results about the inverse relationship between land productivity and farm size were not conclusive.

Sampath (1979) in his study of nature and measurement of economic efficiency in Indian Agriculture found that small farmers were more economically efficient than the large farmers, that is small farmers were more enterprising and innovative than the large farmers in adopting the best technology given the resources position of the farmer.

Junakar (1980) in his studies did not find any difference in economic efficiency between small and large farms, but in absolute sense, both the groups were inefficient, small farmers were allocatively inefficient, while large farmers were technically inefficient. Similar results were also reported by Kalirajan (1981) and Huang et al. (1986).

World Bank (1980) in its report based on farm management studies in India of 1950's covering about 3000 farms in six states observed that the larger farm, the smaller was the output per acre. Even green revolution with high yielding varieties of seed could not change this conclusion. Although the productivity gap between large and small farms tended to be narrow as the green revolution spread, the proportion of land under HYV did not vary by farm size.

Mahmood and Haque (1981) studied the relationship between farm size and output per acre in Pakistan and reported that productivity is high on very small farms

due to intensive labour, irrigation use etc., and large farms due to capital intensive inputs. So they did not observed a definite relationship between farm size and productivity.

Dutta (1982) made a study on relative economic efficiency of farm size and peasant proprietorship in paddy and wheat cultivation of Ranchi district, Bihar, by using Lau-Yotopoulos profit function model. He reported that small farms were relatively more efficient in production of paddy while large farms were more efficient with regard to wheat. Similarly the statistical tests indicated that both in paddy and wheat production the peasant farms were relatively more efficient than the capitalist farms.

Benarjee (1985) studied the relationship between productivity and farm size based on the data of 50 sample farms from seven villages in Haringhata block of district Nadia. All the selected villages were adjacent and had similar agro-climatic characteristic. Inter village variation in resource use, cropping pattern and yield were found to be insignificant. Therefore, all the farmers were pooled together and divided into five groups on the basis of size of operation holding and gross return per hectare. From the result, the author indicated that value of the volume of output per unit land use is a better measure of farm size. Farm classified on the basis of size of holding depicted a rough picture of inverse relationship between farm size and productivity.

Nagaraja and Bathaiah (1985) studied the relationship between farm size and productivity in context of irrigation, cropping intensity, yield per acre, farm business income. The hypothesis tested was the increase in agricultural productivity, yield and income was a result of the adoption of new technology (HYV, implements, irrigation etc.). The results indicated the positive relationship between farm size and yield and farm size and income.

Ghosh (1986) made an attempt to test the reversal of the inverse relationship hypothesis by comparing the relationship for all crop production as well as for individual crop under a traditional technology in mid fifties with that under new technology in seventies in Hooghly district (West Bengal). He observed that material

inputs like fertilizer, manures, insecticides, pesticides, improved tools and implements, which were virtually non-existent in the fifties were used by farmers in remarkable amount in early seventies.

Ghosh (1990) reports positive correlation between farm size and economic efficiency. He found no difference between small and large farms in technical efficiency. His contention was that the difference in economic efficiency was due to difference in allocative efficiency between small and large farms.

Mousa and Jonnes (1991) in their study of analyzing size and efficiency in Egyptian agriculture used econometric approach. The factors which affect farm level productivity were also considered. The results revealed that both the small and large farms were equally efficient in production.

Jain and Bal (1992) in their study of variation in cost of production with farm size in Punjab attempted to estimate the per quintal cost of production of wheat, paddy and cotton as with as the level of input and output on different farm sizes. The authors also tried to examine the role of different factors in explaining the cost efficiency for these crops. The study found that in wheat, large farms were cost efficient producers. Regression analysis revealed inverse relationship of per quintal cost of production with the size of the farm. The study also highlighted that for paddy, the area under crop (farm size) had no effect on the cost efficiency.

Sekar et al. (1994) made an analysis based on data on comprehensive scheme for studying the cost of cultivation of principal crops of Tamil Nadu in the year 1989-90. The analysis revealed that human labour and bullock labour employed per hectare showed a declining trend as farm size increased. Average expense of human labour and fertilizer accounted for nearly sixty per cent of total cost of cultivation. Paddy yield declined as the farm size increased, thereby reducing the return received in terms of profitability. Small farms performed better.

Banik (1994a) in his study on a village in Bangladesh reported that estimated level of technical efficiency in 88 out of 99 sample irrigated farms was 71 per cent or above. Thirteen farms showed technical efficiency of 91 to 100 per cent. The author

also reported that ten out of thirteen efficient farms belonged to the category of small farms.

Banik (1994b) in his study in some villages in Bangladesh regarding farm size and productivity relationship unable to trace any kind of significant relationship between the farm size and productivity in both monsoon and rabi season. According to him, inverse relationship between farm size and productivity may be spurious relationship as in reality there existed numerous other factors which had bearing on the productivity of land operated by individual farm such as cropping intensity, elevation, irrigation etc. when all these factors was considered no definite trend was traced regarding size, relationship.

1.2.3 FARMING SYSTEM ANALYSIS

Yoboah and Wright (1985) discussed several ways in which black small farmers in North Carolina showed increase their farm income through a more efficient allocation of their existing resources. They concluded that income could be increased from 23 to 237 per cent through substituting new crops, decreasing or increasing production of certain crops and less use of hired labour. The limitation of these recommendations was that they assume a risk free environment for farmers who were risk averse.

Doolette (1986) examined the system of crop production in North Africa of rain fed agriculture under arid and semiarid condition in context of drought risk, water use efficiency and tillage practices. He pointed out that trade-off should be required in order to get a stable, less exploitative farming system.

Grosvenor Alsop (1986) using household socio-economic data on Belkunda village in North Bihar, tried to analyse mixed livestock and rice farming systems noting: (i) role of member of different sex in production and decision making, and (ii) competition between rice and livestock farming activities for household labour. He concluded that the amount of female labour time decrease with improvement in the household income.

Prasad and Rao (1986) studied farming system in a drought prone area of Chitlor district in Andhra Pradesh. India on mixed farming system of rice, napier and milk cattle, highlighted sources of labour, production and income levels, interactions between crop and livestock components and the importance of off-farm employment. They concluded that 36 per cent of available labour was devoted to livestock farming, 35 per cent to off farm employment and 29 per cent to crop production. Income from crop production was higher than that obtained from the sale of milk, but the latter was more evenly spread over the year.

Elek (1987) in his study of traditional agricultural villages of Csesztrag, Hungarv discussed four farm types, (i) the traditional farm operated by parents whose children have left in the village, (ii) the mechanised farm with long term plans operated by several generation with livestock farming and industrial activities, (iii) horticultural producers and (iv) single people with a few chickens, small vegetable garden and one or two pigs. He concluded that cattle farming secured to be diminishing because of fodder supply problems and the large work requirement and specialization of production had led to increase income and a decrease in seasonal work load.

Gangwar and Ramakrishnan (1987) presented the findings of a comparative analysis of the agricultural and animal husbandry systems carried out by two tribes of Arunachal Pradesh to north-eastern India, the sulungs and the Nishis. It was concluded that with changing needs the system (shifting) should be updated rather than changed, bearing in mind the differences between the tribes and the ecological conditions of the area.

Kalita (1987) studied the alternative farming systems of Punjab and pointed out that the green revolution has subsequently increased production of rice and wheat in India. However, there was an urgent need to divert to a more stable cropping system to balance the exploitation of major resources and to advance the benefit of the green revolution to marginal and small farmers.

A study of farming techniques by Ninuma (1987) showed that most rice producers cultivated the crop from spring to autumn and worked elsewhere in

winter. Average yield of rice production increased from recent years. Cultivation of other crops was not profitable.

Prasad et al. (1987) studied the integrative nature of the existing farming system and sub-system interactions between crop, livestock and wage employment in the drought prone districts of Andhra Pradesh and concluded that the vagaries of monsoon, limited recharge of water from tube-well and availability of dairy marketing in restructure had led the farmers to adopt a paddy Napier milk cattle system.

Singh and Sharma (1987) in their study evaluated the potential of increasing income and employment on small farms with different farming system in mid-western region of Uttar Pradesh, India among whom 5 farming system were identified. It was observed that a maximum potential of increasing income above existing levels in crops + dairy + goat farming followed by crop + dairy + poultry farming. A purely crop farming system proved to be the poorest choice in terms of income and employment generation.

Tanaka (1987) in a study concluded that upland cropping system in Japan were changing from cereals and pulses towards feed and forage crops, fruits and vegetables. Farmers were eager to improve cultivation techniques to lengthen the effective growing seasons and converse energy use have been developed based on intercropping mixed cropping.

Allertz (1988) studied three principal agricultural activities in Colima, Mexico. The activities were maize, coffee and livestock. Out of which livestock programme had a great impact in transforming the farming system with a competition for land use between maize/follow and improved pastures.

Oberoi et al. (1988) reported that the tribal agriculture was characterised by traditional and subsistence nature of farming with low crop yield and primitive method of cultivation of crops due to basic infrastructural facilities. The study revealed that the farm income could be augmented simply by switching into

optimum cropping pattern. It had been established that the farm income might get 35 per cent increase by re-allocation of area under different crops.

Singh and Sharma (1988) studied 5 different farming system (both crop + livestock) in two district of U.P. with a view to examining the levels of income and employment. They concluded that total income increased by 11 per cent and family labour employment by 28 per cent under the cropping system. The crop + dairy + goat system gave the highest increase in income (52 per cent) and labour (34 per cent) employment opportunities.

Srivastawa (1988) in his study concluded that farmers irrespective of holding size who keep a dairy or poultry enterprise on a predominantly cropping pattern, even on a small size were better able to stand adverse geographic and socio-economic condition than were those who specialise purely in crop production. Such a system allowed for the efficient recycling of farm waste and socio-economic security of diversification.

Jue (1989) studied three models of the farming systems in the wetter tropics as the irrigated rice multi-storey homestead garden complex in Asia, the tree and cash crop plantations of Latin America and the method root crop brush fallow systems of Africa. He concluded that there was a great potential for the improvement and adoption of multi-storey homestead gardens and mixed systems which include trees, annual and perennial crops.

Nagaraja (1990) in a study compared yields, costs, returns and employment use under four crop mixtures and eight mono cropping systems in Anantpur district in Andhra Pradesh. He pointed out that crop mixtures produced higher yield without any adverse effects on the yield of the base crop in rain fed areas. The average additional gross monetary return of crop mixtures over mono cropping was Rs. 466 per acre and net income was also higher. Crop mixtures which on average had a higher-labour requirement offer employment generation opportunities.

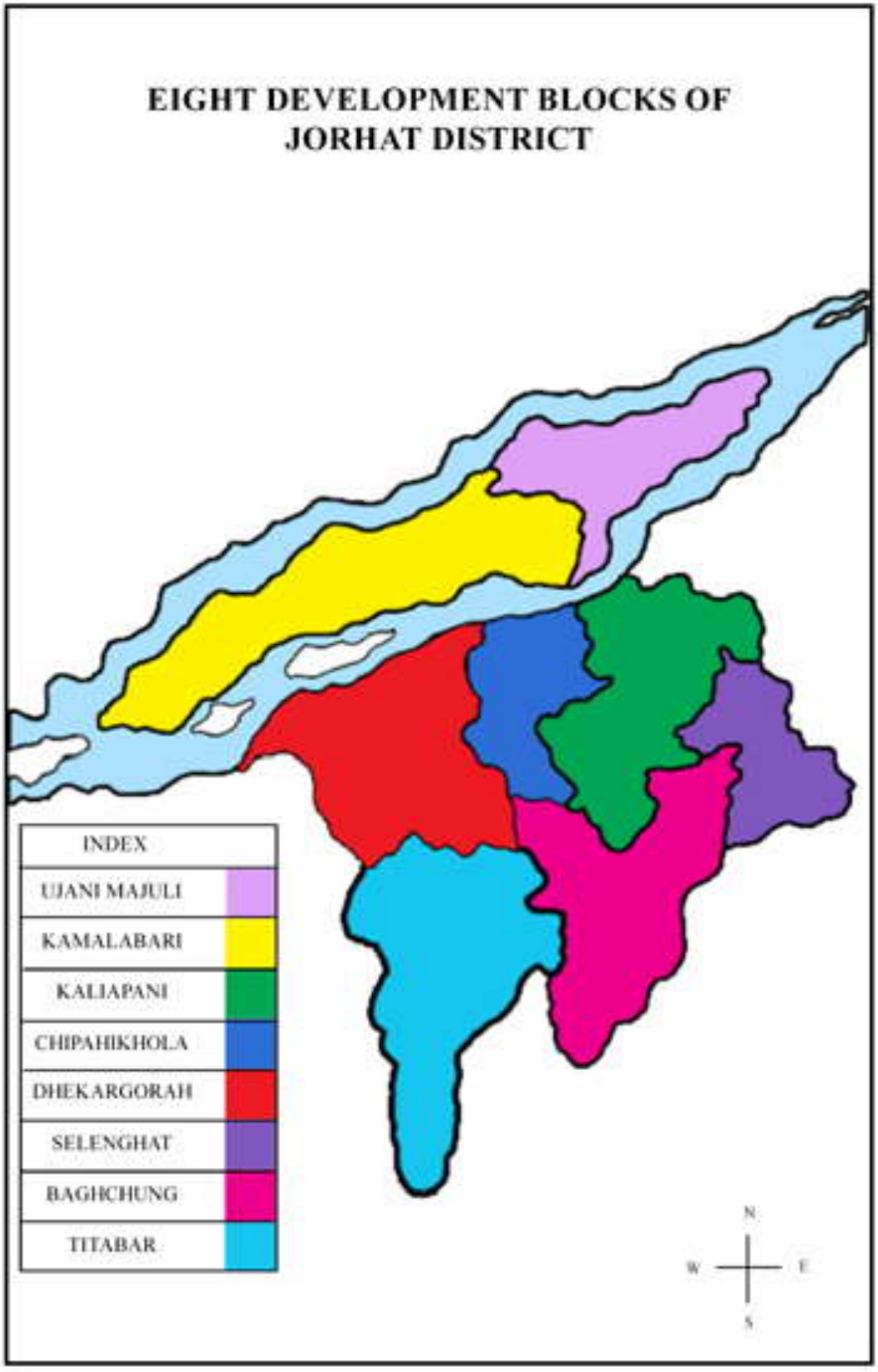
EIGHT DEVELOPMENT BLOCKS OF
JORHAT DISTRICT
INDEX
UJANI MAJULI
KAMALABARI
KALIAPANI
CHIPAHIKHOLA
DHEKARGORAH
SELENGHAT
BAGHCHUNG
TITABAR
N
W
E
S

FIG 1.2

1.1. STUDY AREA

The present study pertains to the Jorhat district of Assam, comprising 3 sub-divisions i.e., Jorhat, Titabor and Majuli. Under these 3 sub-divisions there are 8 development blocks viz. Baghchung, Titabor, Dhekorgorah, Chipahikhola, Selenghat, Kaliapani, Kamalabari and Ujoni Majuli. The mighty river Brahmaputra is passing through the district making it very fertile. Geographically Jorhat district lies between the $26^0 45^/$ North to $27^0 12^/$ North latitude and $94^0 05^/$ East to $94^0 35^/$ East longitude. The study is being divided into two following heads – Physical setting, and Socio-economic setting.

1.3.1 PHYSICAL SETTING

Agriculture is not only the growing of crops; it is also a form of applied ecology. Agriculture is directly dependent on the immediate natural environment, which can be changed only at heavy cost. Initially agricultural systems are imposed by the physical conditions till the later are modified. Assam, in general and Jorhat district in particularly reveals contrasts in agricultural characteristics which are largely because of differences in environment.

Physical factors affecting agriculture may be divided into location, physiography, geology, relief, drainage, climate, soil, and natural vegetation. Although they are clearly inter related, for instance, climate is influenced by altitude and also slope aspects, soil by rainfall and evapo-transpiration etc. Therefore, the role of these factors in the areal agricultural complex is undeniable.

1.3.1.1 LOCATION

Jorhat, the last capital of Ahom kingdom is situated in the eastern part of Assam. The Geographical boundary of the study area is bounded by Brahmaputra River, and North Lakhimpur district in the north, Nagaland on the south. The district of Golaghat to the west and the eastern direction is covered by river Janghi and the district of Sibsagar.

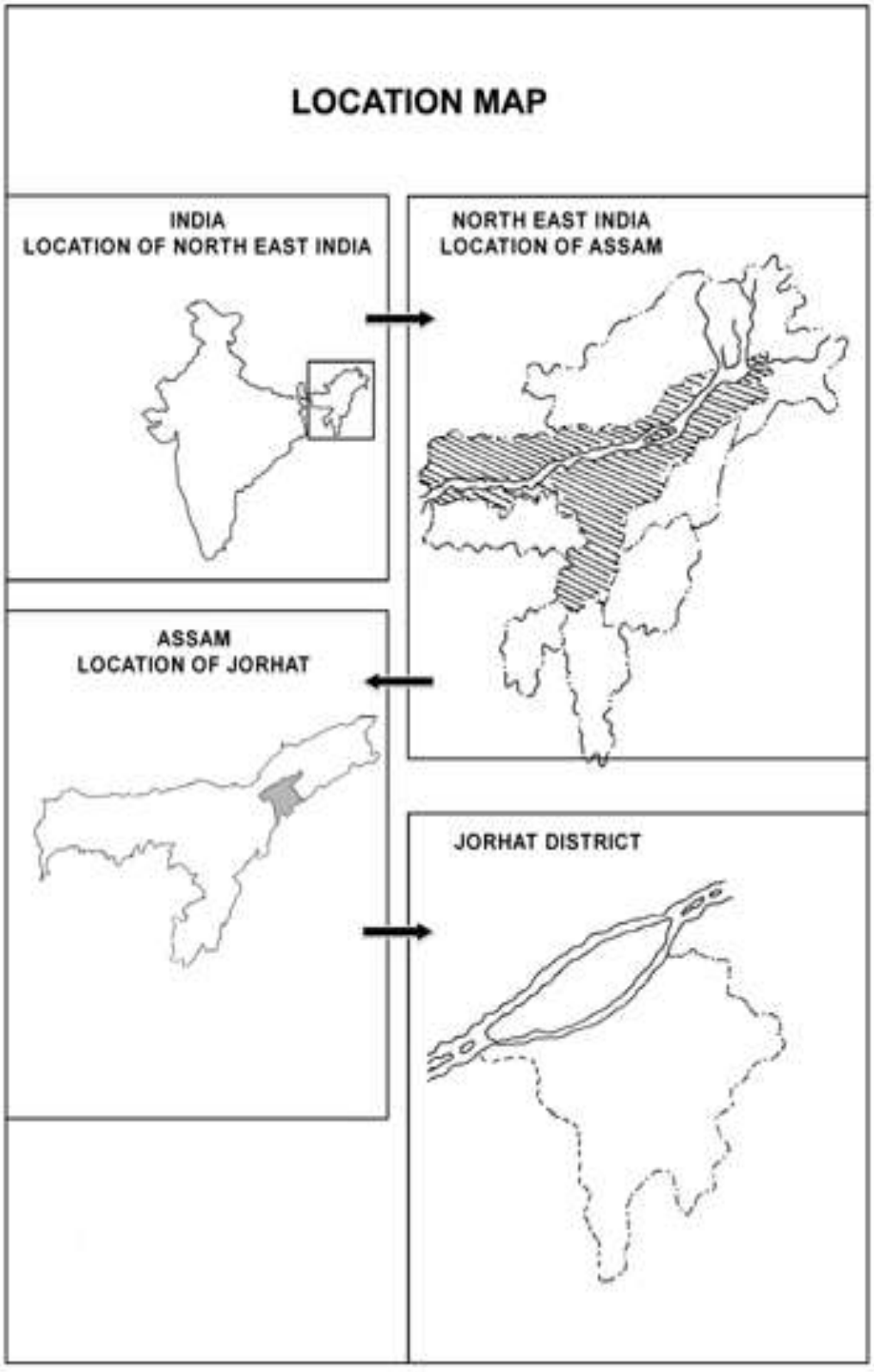
LOCATION MAP
INDIA
LOCATION OF NORTH EAST INDIA
NORTH EAST INDIA
LOCATION OF ASSAM
ASSAM
LOCATION OF JORHAT
JORHAT DISTRICT

FIG 1.3

The total geographical area of the Jorhat district is 2851 square kilometres with 110 Gram Panchayat and 707 inhabited villages. As per 2011 census, the total population of the study area is 1091295, comprises of 557944 male and 533351 female respectively. The total number of rural area under Jorhat district is 278.36 sq. Km. whereas, in the under urban area, it is recorded as 69.64 sq. Km. The total number of villages under the study region is 866 and registered town is only two i.e., Jorhat and Mariani.

The entire study region is thickly populated and density of population of the district is recorded as 383 persons per sq. Km. against the state figure of 397 according to 2011 census. The density of population in the district was 350 persons per sq. Km. and the state figure was 340 persons in 2001. In the last one decade, the density of population per sq. Km. has been increased up to 33 persons in the district against the state figure of 57 persons.[9]

1.3.1.2. PHYSIOGRAPHY

Physiographically the study region is located in two parts. The northern part is located on Brahmaputra valley or Assam valley and southern part is located on Disoi valley along the foothills of Naga range. The northern part of the region is alluvial plain cress-crossed with numerous rivers and waterways and dotted over with 'beels' and marshes. The surface structure of southern part of the region is formed by the eroded material coming from Naga range. The entire study region consists of an area of 2851 sq. Km. representing 3.63 per cent of the total geographical area of the state.

The whole Brahmaputra valley consists of an area of 56,339 sq. Km. it is an alluvial plain formed by the depositional work of river Brahmaputra and in to innumerable tributaries. The altitude of the valley is 200 meters above mean sea level. The length of the valley is 725 km. from Sadiya to Dhubri with an average width of 80 km. The general slope of the valley is north to south in the north bank and south to north in the south bank of the river Brahmaputra. The general gradient of the valley from north-east to south-west is 12.5 cm. per km. As the river is sluggish with a low gradient, innumerable almond shaped river islands called 'Chaporis' or

[9] Office of the district Economics and Statistics, Jorhat, 2014-15.

'Char' are formed by the deposition of sediments in the middle of the river course. Most of these 'Chaporis' are washed away by flood during rainy season while new chaporis are formed. The land surface of Jorhat district may be divided into three distinct physiographic zones running parallel or sub parallel to the Brahmaputra River.[10] These are as follows.

1.3.1.2.(i) The active flood plains and char land

South of the Brahmaputra River, there lies an extensive and active flood plain region. The island inside the river course i.e., 'Majuli' may also be included in these zones. The whole island and south bank of this river especially Neemati are mostly flood prone area. Several floods are experienced every year in all these area. Another flood plain area is found along with the river Bhogdoi. It is a narrow strip of low-lying area ranging in width from 10 meters to 30 meters. The development of this flood plain is the result of maximum number of meandering and shifting of the river. The erosion is still going on.

1.3.1.2.(ii) The middle plain or highland zones.

The highland plain zone is found between the active flood plain and the southern foothills zone. It is an extensive plain area spreading east-west parallel to the course of river Brahmaputra. Although it is almost highland, it is covered by a plain surface. The average height of this zone is about 80 meters from the mean sea level. This is one of the most densely populated area contains the rice belt and tea growing area of the region.

[10] Negi. B.S.(1991), *Regional Geography of India*, Kedar Nath Publication, Meerut, New Delhi.

SATELLITE IMAGERY MAP OF JORHAT DISTRICT

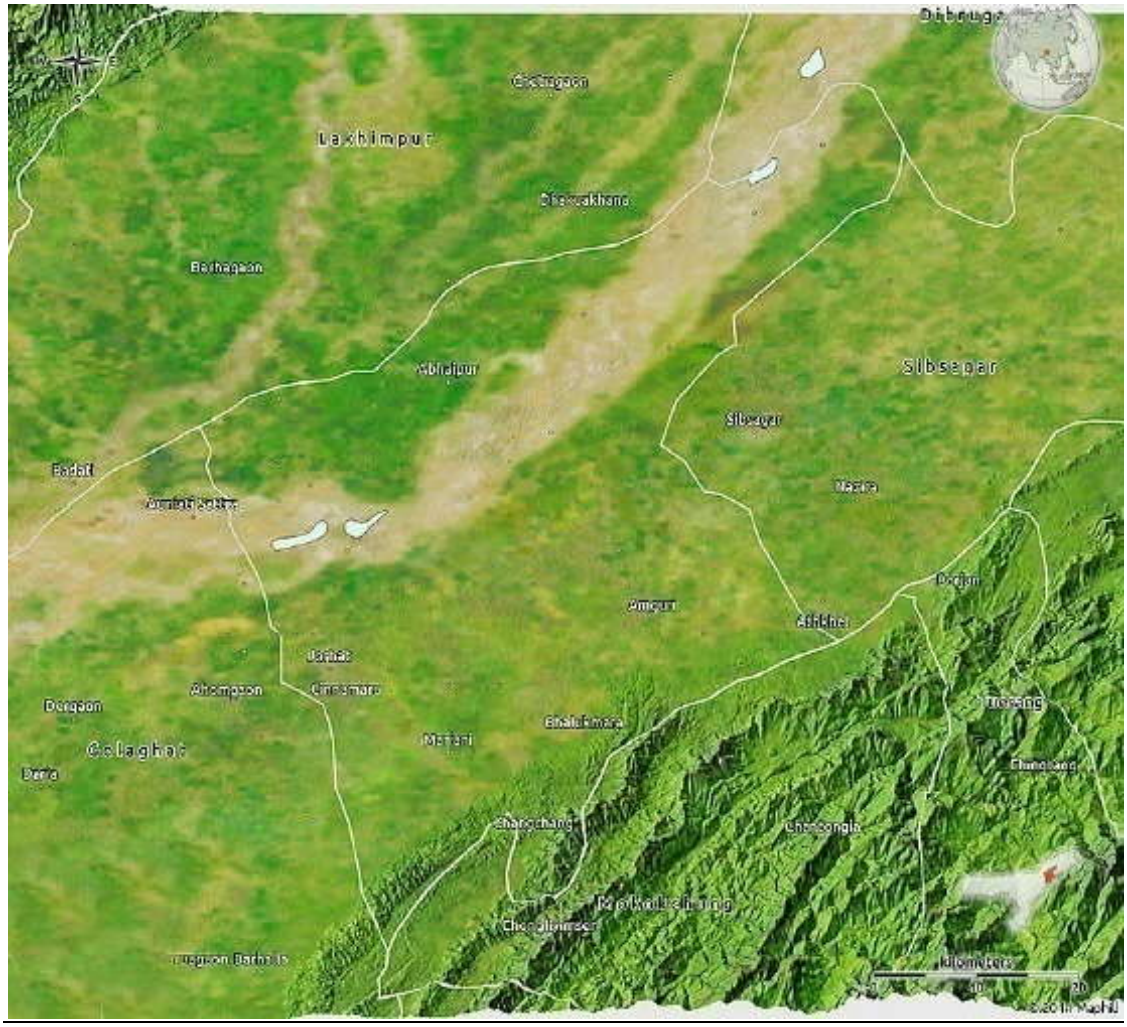

FIG 1.4

1.3.1.2.(iii) The southern foot hill zones

This region is found in the southern most parts of the district. This zone consists of innumerable highland and isolated hillocks interspread with plain embayment entering into the Naga Hills. The high grounds composed of laterite soils are covered with either tea garden or dense forest. The entire zone is under the "Belt of Schuppen". This "Belt of Schuppen" area is most dangerous from the seismic point of view and one of the most disturbed zones of North Eastern region.

1.3.1.3. GEOLOGY

The whole study area is formed of two basic structural divisions. (1) The gentle slope plain zone is structurally a part of the Himalayan geosynclines, which was formed during the late Miocene to lower Pleistocene period, and (2) The plain zone of graded topography is an extension of the Brahmaputra fordeep formed of alluvial debris.

The gentle slope plain zone is lying on the southern part of the district, which is comprises along the belt of 25 km. This area is practically demarcated the belt of Schuppen and the Assam valley plain. The part of the zone is composed principally of blue grey and smothered clays with few sandstone beds and is invariably associated with the ground. The upper gentle slope plain area is full of bedded sandstones with subordinates carbonaceous shale and clay and coolly shale give rise to a slop form of 25/100 gradient.

The plain zone area represents the infilling of a fare deep down along the tertiary bedrocks of Himalaya. But it is clear that infilling is a very unequal depth. The thickness of sub-crust is very high, which is covered of sub-recent alluvial deposition. The north-eastern part of this zone is extended a flood plain area along the river Brahmaputra and Bhogdoi. The broad flood plains are formed of river borne alluvial deposition.

The geological history of Jorhat district, which comprises of eight development blocks, as a whole, is related to two long narrow subsiding trough (Geosynclines) lying on either side of an old rigid continental shield (foreland). The

foreland is geologically a south-western continuation of the Shillong and Mikir Hills plateau and is concealed in the valley by a great thickness of alluvial and tertiary rocks. To the south of this mainland of Archaean rocks was ancient central geosynclines sea known as Tethys. An arm of a sea invaded Assam from the south in the Cretaceous time. With the beginning of the tertiary era, the sea extended further south–east and submerged the greater part of Assam. But for occasional and temporary retreat of the sea, marine conditions prevailed till about the Miocene time. Hundreds of meters of sediments were deposited on the foreland as well as in the geosynclines, the floor of which was slowly but continuously sinking.[11]

Geological succession of the whole study area can be summarized as follows-

Table 1.1

Epoch	Period	Time	Local Terminology	Rock Formation	Thickness
Tertiary	Eoceneo-ligoene	20-1.7 m yrs.	Disang Series	Shales, sandstone, coal, clay, forsile fevcous sedimentary rock.	More 15000 ft.
Quarternery	-	1.7 – 10000	-	Consolidated clay, sand silt, boulders, gravel and alluvium.	-
Recent	Holocene	10,000	-	Clay, sand, silt, boulders, gravel and alluvium.	-

Source: Wadia, D.N.,(1953), The Geology of India, 3rd edition, Macmillan, London.

Meanwhile, a series of intermittent earth movement went on in the Assam region. The movement accentuated in the post Pliocene age and the piles of sediments that were severely compressed and uplifted into the lofty Himalaya in the north and Naga, Lushai and other associated ranges of hills in the south. Erosion

[11] Geological Survey of India, (1974), "Geology and Mineral Resources of the states of India".

moved many hundreds of metres of materials from the rising areas. Finally, deposition on the foreland areas of the Jorhat district is presumably late in the Disang times and continued until the present day. The geology of the entire region is thus concealed by alluvial deposits. Geological surveys, aided by drilling for oil, have shown that under the recent deposits there are hundreds of metres of Tertiary sediments, which lie over an Archaean Basement Complex.

Geologically, Assam possesses rocks from the Archaean, Pre-Cambrian to the Lower and Upper Tertiary, i.e., from oldest group of rocks to the youngest one. The Archaean rocks in the form of metamorphic complex of gneisses and schist intruded by younger acidic and basic rocks in the northern and central parts of Mikir Hills and isolated inselberg of the Archaeans scattered along the north and south banks of Brahmaputra in Goalpara, Kamrup, Darrang, and Nagaon district. Stratigraphically, the Archaean group consists of banded composite, biotite, biotite home lalend, biotite sillmanite gneisses and schist, associated with fieldspathic biotite, pyroxene, horn blend granulites, cele-granulitics, aplites and younger course to fine grained granite, gneisses intruded by massive perphyritic and coarse biotite granites, pegmatite and quartz veins.[12]

The Pre-Cambrian groups consisting of quartites and phyllites restricted to small areas over the western flank of the Mikir Hills and northern part of the North Cachar Hills. The Achaeans are overlain by the Pre-Cambrian Shillong groups of rocks in the northern part of the North-Cachar Hills and over in small areas over the western flank of the Mikir Hills across the Kapili valley in Assam. Here the rocks are mainly quartzard phyllete.

The lower tertiary shelf sediment of Jaintia group (Eocene) extending along the southern flanks of the Mikir Hills as well as the geosynclinal Disang group over parts of the North Cachar Hills. The Jaintia group extends in the north-easterly direction along the southern and eastern slopes of the Mikir Hills. In these hills, workable seams of coal and lime deposits are the major economic minerals.

[12] Pandey, S.N.(1978), *Morphology and Evaluation of Landform*, Delhi University.

In Assam, the Disang are restricted to a narrow strip to the south of Haflong. Disang thrust in the central part of North Cachar Hills, from the Jaintia valley eastward up to the headwaters of Dhansiri.

The Upper tertiary (Oligocene-Miocene-Plio self and geosynslinal-cene) sediments covering the southern flanks of Mikir Hills, the North Cachar Hills and the Hills of the Cachar district in the Surma Valley, the north foothills of the Naga-Patkai range bordering the southern margin of the Sibsagar and Dibrugarh districts, and narrow fringe of under classified Siwalicks along the southern foothills of the eastern Himalayas facing the northern border of Assam.

Unclassified older and newer alluviums (quaternary deposits) comprising high level terraces, the red bank soils and the recent alluvial deposits of the Brahmaputra and Surma Valley. The new alluvial soil consists of indurate yellowish to brownish or reddish clay with sand, gravel and boulder deposits. The alluvium formation shows much variation in depth ranging approximately from 200 to 300 meters.

1.3.1.4. RELIEF

The whole study area is under undulating topography. The area is characterized by three major types of landforms are zone of highlands or uplands, zone of plain lands topography and zone of low lands topography.[13] Highlands's relief is recorded in Nanka chu at about 140 meters altitude above mean sea level. Average relief recorded height is from 80 to 100 meters from sea level. The low land records an elevation of about 40 to 50 meters from mean sea level.

1.3.1.4.(i) Zone of Highlands or Uplands Topography

This belt is situated at the foothill zone of Naga hill. General elevation of this zone is 120 meters from the mean sea level. However, some area is along 140 meters height up to the junction of Nanka chu. Longsemtong is the highest peak of this zone. This slope is a fall of 48.90 at a distance of just 4.5 km. from Longsemtong to the valley floor.

[13] Ibid.

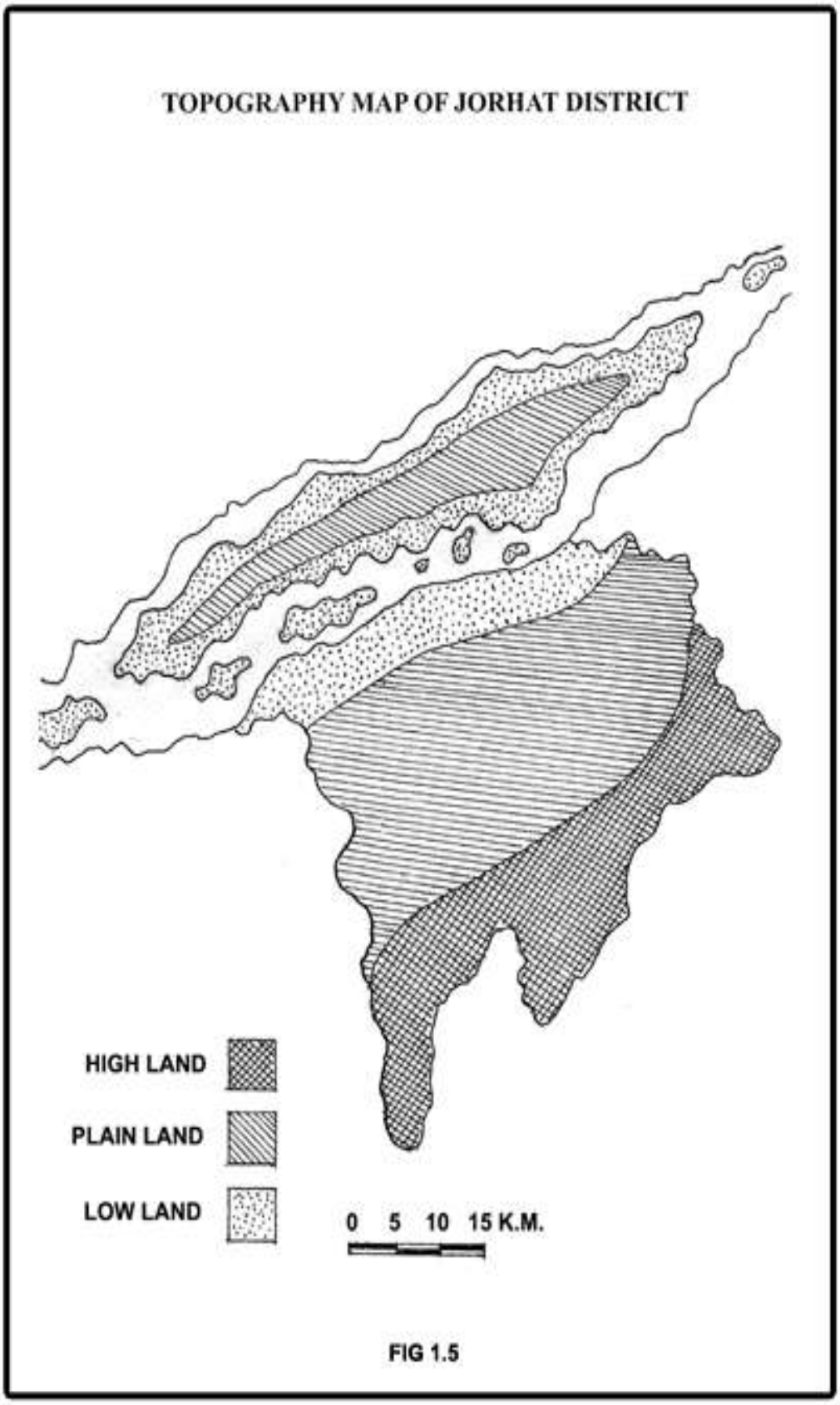
TOPOGRAPHY MAP OF JORHAT DISTRICT
HIGH LAND
PLAIN LAND
LOW LAND
0 5 10 15 K.M.

FIG 1.5

1.3.1.4.(ii) Zone of Plain lands Topography

The entire area covered nearly 30 sq. Km. starting from the valley floor zone up to the Jorhat town. This area is lying between 60-100 meters height. The average elevation is 80 meters. Though there is some undulating topography in this part, it is almost plain with gentle slope. Alluvial covers of the surface above 15 meter.

1.3.1.4.(iii) Zone of Low lands Topography

This zone lying between 40-60 meters contour is flood plain zone of river Brahmaputra. Except so sparsely located small hillocks and dams, the entire topography of this part is almost plain with very gentle slope. The flood plain zone is extended from the ground level with a slope of just 3.43. Relief is very low and maximum relative relief in this part is only 10 meters.

1.3.1.5. DRAINAGE

The entire area under study is a portion of the Brahmaputra river catchments. It controls the entire drainage system of the valley. It flows through the northern part of the district from east to west. It develops the river island Mazuli on its course. In this area two development blocks is considered out of eight development blocks in the present study. Swamps and marshes are ubiquitous along the course of the Brahmaputra and its tributaries in the region.

Brahmaputra, the principal river of the study area, which flows through the entire region, and the whole drainage of the region ultimately find their way to it. All the major north bank tributaries of Brahmaputra originate in Himalaya where the south bank tributaries are originated from Naga Hills.

The principal tributaries of the study area are Bhogdoi, Jangi and Kakodunga are the two tributaries, which separated Jorhat district from Sibsagar and Golaghat district respectively. All these three rivers are originated from the Naga Hills.

The drainage system of the entire Jorhat district is dominated by river Bhogdoi that is one of the south bank tributaries of Brahmaputra. The area is drained by the Bhogdoi River itself along flows the heart of the district. The Jangi River lies on

DRAINAGE PATTERN OF BHOGDOI BASIN

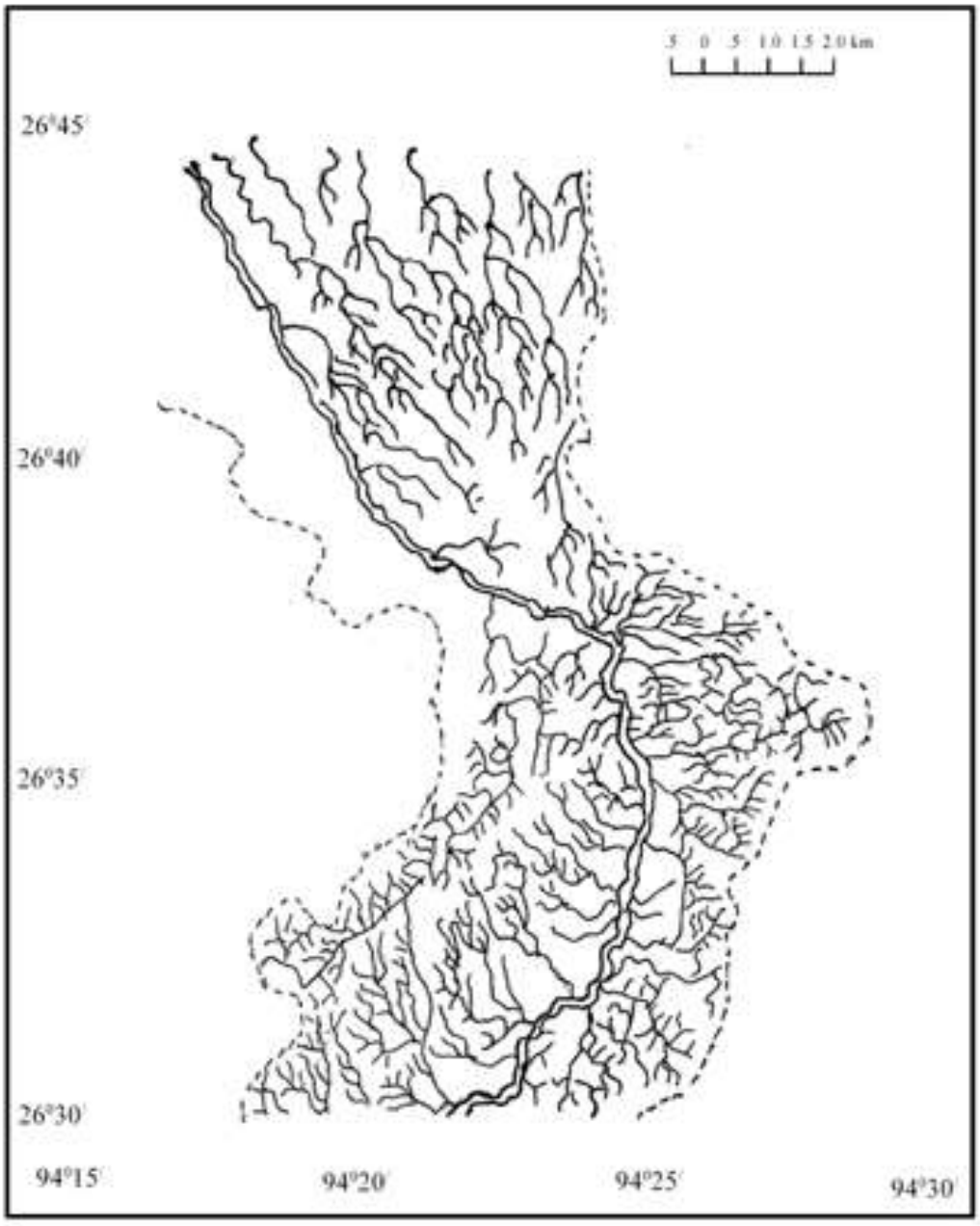

FIG 1.6

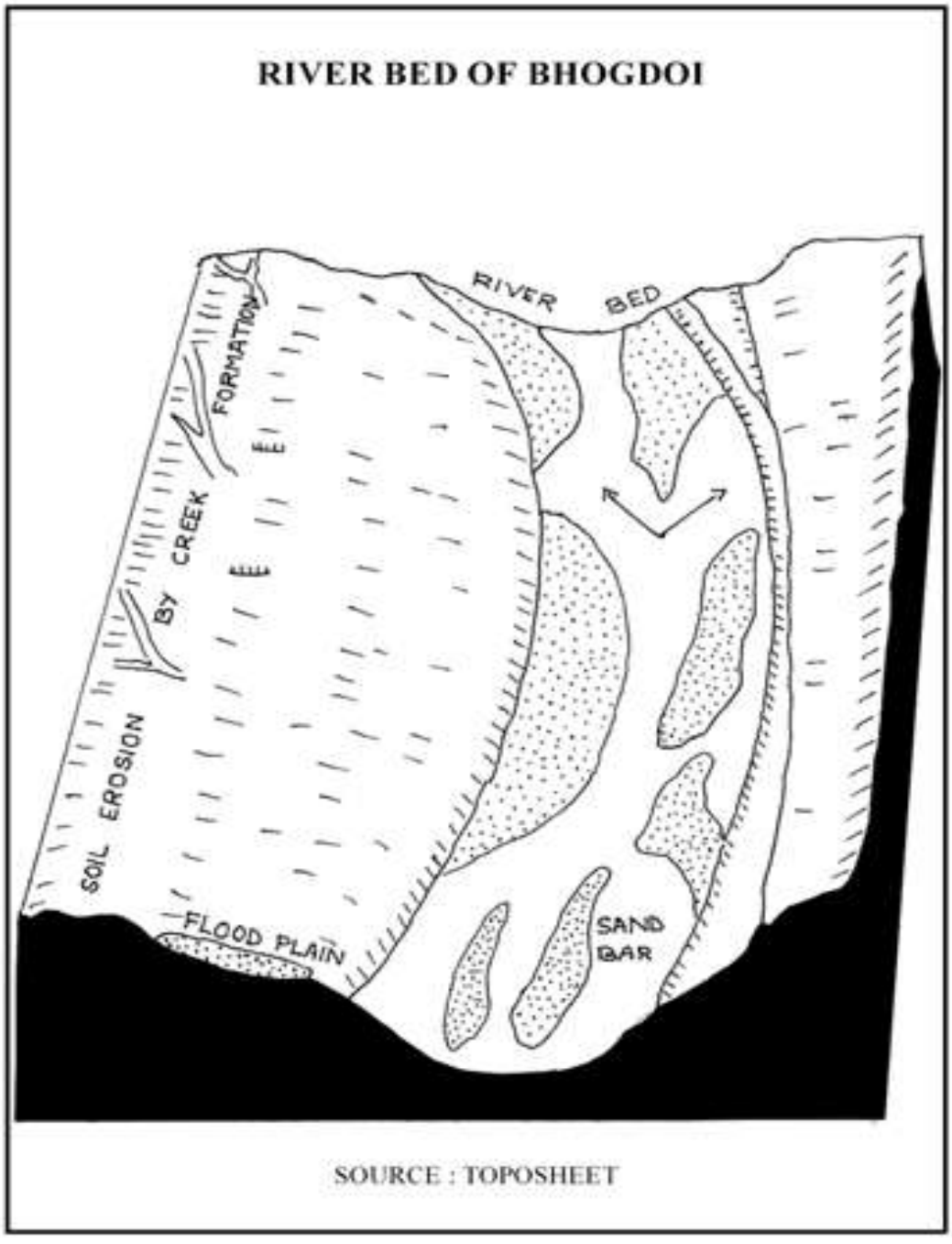
RIVER BED OF BHOGDOI
RIVER
BED
FORMATION
BY CREEK
SOIL EROSION
FLOOD PLAIN
SAND BAR
SOURCE : TOPOSHEET

FIG 1.7

the eastern boundary, which separated Jorhat district from Sibsagar, and the Kakodunga River lies on the western part of the district, which separated Jorhat from Golaghat district. On the intervening area of these basins, numerous discontinuous streams, sills and gullies have been developed. The flat topped interfluves, shallow fan like river beds with over bank flood plain, studded with several meanders and oxbow lakes are the characteristics landform features of this area. Geomorphologically, the river Bhogdoi is reaching almost late mature stage. It is a non perennial river and the density measures medium to coarse. This channel is flat bottomed with steep bank side slope. The bank sides are affected by back full and siltation or formation of point bars, shoals and sand bars, which are common features of this area. The features of creeks and gully are visualized in the bank side of the river.

Among numerous streams of Bhogdoi, Junka Chu is the longest and almost parallel course of the main stream. Among the east flowing streams Junka Kung Khung, Lietoumechung, Lingrak are the major streams, while the rest flowing streams are Mengat, Ailang, Charma, Tikhang etc. Among the north flowing streams Kaliapani, Rangajan, Meleng are prime and almost all of them are flowing through the plain area of the basin.[14] In addition, to the streams mentioned above are carrying the sediments of the Hills into tributaries Bhogdoi, which finally fall into the river Brahmaputra.

1.3.1.6. SOIL

The soil of the study area is broadly alluvial in character. The new alluvial soil is found in the middle plain of the area in the south of the river Brahmaputra. An elongated narrow patch of old alluvial soil occurs along the southern margin of middle plain of the region. On the other hand, to the southern margin of the region along with the foothills of Naga Hills mostly red loamy and lateritic soils (hill soils) are found. In between new alluvial and hill soils in the south bank of the river Brahmaputra, the soil type is mostly old alluvial which covers an extensive area of Jorhat district. Broadly speaking, the soil of Jorhat district is acidic in character with a

[14] "Souvenir" 11th Annual Conference, N. E. India Geographical Society, held at Mariani College.

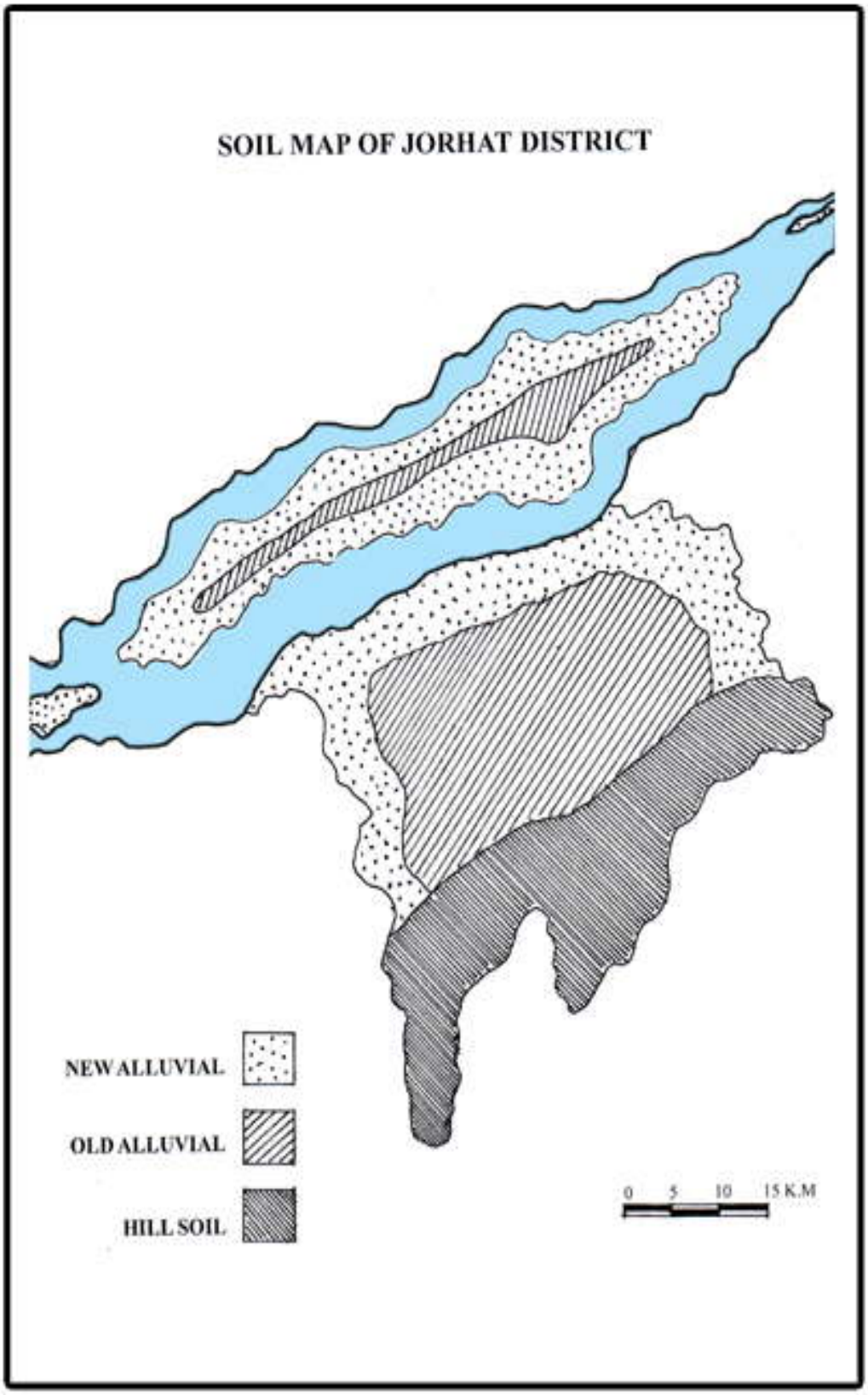
SOIL MAP OF JORHAT DISTRICT
NEW ALLUVIAL
OLD ALLUVIAL
HILL SOIL
0 5 10 15 K.M

FIG 1.8

satisfactory content of nitrogen and organic matter. On the basis of the soil characteristic, the area can be divided into three major soil divisions.[15] They are (1) New Alluvial Soil, (2) Old Alluvial Soil and (3) Hill or Upland Soil.

1.3.1.6.(i) New Alluvial Soil

The recent revering new alluvial soils are derived mainly from the material deposited by the river Brahmaputra and its tributary Bhogdoi. So this type of soil is mostly found in the low land zone, which is, situated in the bank of river Brahmautra and the bank of river Bhogdoi. Flood occurs frequently in this area causing great variation in mechanical composition and chemical properties due to the deposition of sediments, which differ greatly depending upon the parent materials in their respective catchments areas. The texture of the uppermost horizons of these soils is sandy, silty or clayed loam. In general, the lowermost horizons are mostly sandy or loamy sand and soil texture become lighter along with depth, less acidic and often neutral or slightly alkaline (PH 5.5). This soil is suitable for cultivation. They are rich in available phosphate, potash and exchangeable calcium. The ground water table is 1 to 3 meters in some areas.

1.3.1.6.(ii) Old Alluvial Soil

The old alluvial soil is found in the up plain land area of the region. This type of soils are formed from the materials deposited by the river Brahmaputra and its tributary Bhogdoi in the long past. This group of soil is mainly found in the region parallel in between new alluvial and hill soil to the south. The ground water table is generally deeper than the recent revering alluvial soil. Profile development has taken place to some extent. These soils are more acidic and are usually deficient in available phosphate with low to medium proportion of potash. In texture, this soil varies from sandy to clayey loam with high to low content of nitrogen. The PH value is low 4.2 to 5.5 with very low exchangeable calcium. The acidic character of these soils makes the area very suitable for tea plantation.

[15] Singh, R. L. (1971), *Regional Geography of India*, National Geographical Society, Baranashi, India.

1.3.1.6.(iii) Hill or Upland Soil

The hill or upland soil generally found in the foothill zone of Naga Hills. These soils are built of alluvial materials wash down from the hill slopes. The surface soils are compact, very sticky and very plastic. The texture of the soil also becomes heavier along with depth. This type of soil again can be divided into two sub groups. They are (a) Ferrogenous Red Soil and (b) Laterite Soil.

The ferrogenous red soil is poor in time, potash, iron oxide and phosphorus content. The clay in the red soil has developed 'Kaolintic' structure. The main characteristic of this soil group are light texture and porous and flexible structure. The laterite soil occupies a very little part of the region along the hill border of the basin. The soil is compact to vesicular and efficient in potash, phosphoric acid, lime and oxides of alkali and alkaline earth metals.

1.3.1.7. CLIMATE

From the climatic point of view the region forms an integral part of the Monsoon lands. The climate of the region is not much different from that of the rest of Monsoon lands. The climate of the region is not much different from that of the rest of the state. The climate of this region enjoys with variants ranging from tropical to temperate condition. It is characterized by heavy rainfall in summer and drought in winter, very high percentage of relative humidity, relatively less temperature and general coolness. The rapid changes in topography result in climate changes within short distances. The cold season from December to February, is followed by the season of severe thunderstorms from March to May. The south- west monsoon season in the valley is from June to about the beginning of October. October and November constitute the post monsoon season.

The mean annual temperature of the valley is 22.79^0 C with mean relative humidity of 80.25 per cent. The average annual rainfall in the valley is 2197.00 mm. The rainfall generally increases from the south to north. About 64 per cent of the annual rainfall is received during the monsoon season. July is being the month with maximum rainfall. On an average, there are about 199 rainy days in a year.

Table 1.2

MONTHLY MAXIMUM AND MINIMUM TEMPERATURE AND RAINFALL IN JORHAT DISTRICT.

Months	Maximum Temperature in 0 C	Minimum Temperature in 0 C	Average Temperature	Average Rainfall
January	23.35	7.96	15.65	0.09
February	23.32	14.14	18.73	0.26
March	28.12	14.83	21.47	0.40
April	27.63	17.60	22.61	1.0
May	27.55	26.03	26.79	1.71
June	32.00	24.6	28.3	3.15
July	34.32	24.83	29.57	4.93
August	33.36	23.00	28.18	4.92
September	29.83	22.46	26.11	6.59
October	29.83	20.32	24.87	6.59
November	26.32	14.46	20.34	0.5
December	22.58	9.22	15.88	0.3

Source: Rain and Forest Research Institute, Jorhat, 2015

The climate of the region exhibits a strong seasonal condition which is being divided in to four characteristics seasons. [16] They are (i) Pre Monsoon, (ii) Monsoon, (iii) Retreating Monsoon and (iv) Winter.

1.3.1.7.(i) Pre Monsoon

The pre monsoon begins in the early part of March and continues up to the end of May. Temperature starts rising gradually from the beginning of the seasonal onward. The maximum temperature of this season is 28^0 C and the minimum is only 14^0 C. Cool and enjoyable morning, hot and drying afternoon and occasional thunder shows are some of the important characteristics of this season. The average rainfall is 1.0^0 C.

[16] Ibid.

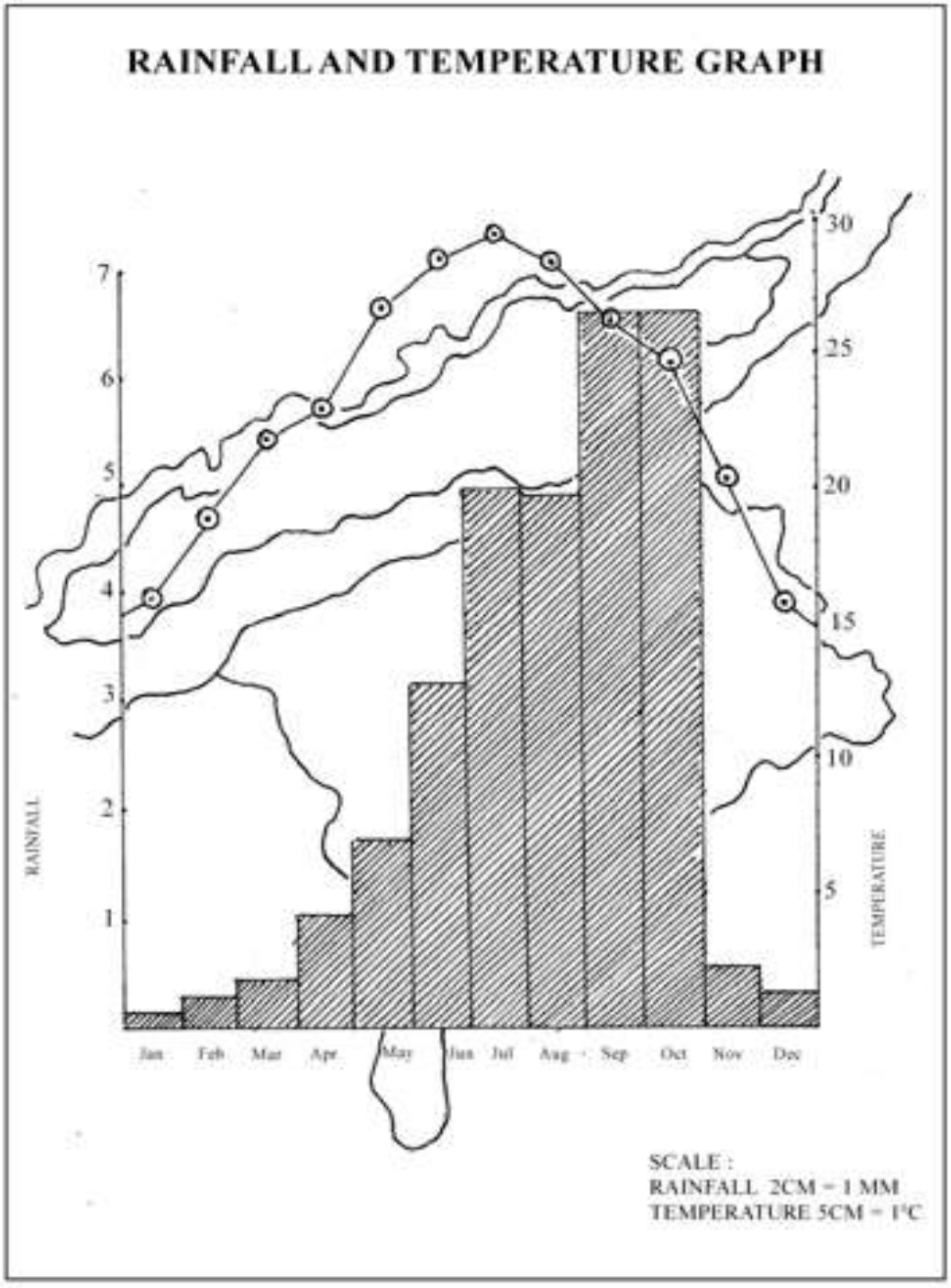
RAINFALL AND TEMPERATURE GRAPH
RAINFALL
TEMPERATURE
7
6
5
4
3
2
1
30
25
20
15
10
5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
SCALE :
RAINFALL 2CM = 1 MM
TEMPERATURE 5CM = 1°C

FIG 1.9

1.3.1.7.(ii) Monsoon

The onset of monsoon nearly takes place in June and it continues lasts up to September. This season is the period of the year with the highest temperature. The maximum and minimum temperatures are 37^0 C and 23^0 C respectively. This rainy season is characterized by high humidity, cloudy sky and heavy rainfall. In these days, the weather is often unpleasant with the damp heat particularly in between the spells of rain. Rain is so frequent that about 12 to 15 days in a month are normally recorded to be rainy. Sometimes rainfall occurs for 5-7 days without stop. The average rainfall of this season is 8^0 to 10^0 C.

1.3.1.7.(iii) Retreating Monsoon

The south west monsoon starts retreating by late September. This season continue up to the middle of November, when fogs commonly occur in the morning. In this season the temperature moves downward and the sky becomes clean. The season is a most pleasant part of the year. The amount of total annual rainfall in the region varies from a minimum of 100 cm to a maximum of over 300 cm.

1.3.1.7.(iv) Winter

The cold season starts by the end of November and continues up to the end of February, where both day and night temperature begins to drop rapidly. The main characteristic of this season is absence of rainfall, cold and dry weather, low temperature associated with frequent morning fogs. The beginning of winter is marked by a steep fall in temperature almost 5^0 C during the first month, i.e., December, January is the coldest month. In February, the temperature starts rising gradually. The winter winds are generally weak and variable. The maximum temperature, which falls in plain area, is 20^0 C to 22^0 C and the minimum temperature is 4^0 C to 7^0 C which are generally seen in foot hills zones.

1.3.1.8. NATURAL VEGETATION

Jorhat may still be considered as a treasure of natural vegetation though its forests have suffered a lot due to old Jhuming practices. In the study area variation of altitude, latitude, climate and soil have given rise to a diversity of forest types ranging

from tropical deciduous, semi evergreen and the coniferous forest specially Mango, Nahar, Hallong, Som, Gunsorei, Makai, Sepa, Bamboo, Betel-nut etc. Grass lands are very commonly found in the southern part of the district. Tea garden vegetation is very common in and around the study area. The most famous sanctuary “Gibon” is located in the southern part of the district near Mariani town which supporting various types of species of natural vegetation.

Among the most common species seen on lower elevations is of the Naya Bho which is seen throughout and on the foot hills. Photili and Photokala grows in deep requires and assume the farm of small trees and bamboo jungle is extensive everywhere.

1.3.1.9. AGRO-CLIMATIC CONDITION

Identification of specific agro-climatic zone is essential, particularly for planning crop improvement programme. Based on the rainfall, terrain and soil characteristics, Assam has been broadly delineated into the following six agro-climatic zones- a) The North Bank Plains, b) The Upper Brahmaputra Valley, c) The Central Brahmaputra Valley, d) The lower Brahmaputra Valley, and f) The Hills.

The study area is entirely belongs to Upper Brahmaputra Valley zone whose physiography is characterized by plains and foothills which is mostly subject to erosion. Soil is composed of both new and old alluvial and is highly acidic. In general, the climate is humid and pre-humid. The crops grown in the region are rice, sugarcane, mustard, rabi, pulses and tea, etc.

This zone is comprises of eight development blocks under Jorhat district i.e., Baghchung, Titabor, Dhekorgorah, Chipahikhola, Selenghat, Kaliapani, Kamalabari, Ujoni Majuli with an area of 2851 sq. Km., according for 3.63 per cent of the total

Table 1.3

AGRO CLIMATIC ZONES OF ASSAM AND THEIR BASIC CHARACTERISTICS

Zone	Physiography	Soil	Crops	Climate
Upper Assam Brahma-putra Valley	Plain and foothill Subject to Erosion	New alluvial (enti-soils) mostly neutral soil, old alluvial	Rice, Sugarcane, Mustard, Rabi, Pulses and Tea.	Pre-humid and humid
Central Brahma-putra valley	Plains and foothills	New alluvium mostly flood-plain alluvium in mountain valley upland, alluvium acidic to strongly acidic reaction.	Rice, Jute, Wheat, Oilseeds, Pulses	Humid and Sub-humid.
Lower Brahmaputra valley	Plains, hillocks and foothills, char areas	New alluvium, old alluvium of two types altisols and ultisols and inceptisols and altisols.	Wetland rice, upland rice, jute large variety of rabi crops, wheat, pulses, and potato.	Humid and Pre-humid
Barak Valley	Undulating scattered hillocks sub-mountain in parts	Mostly old alluvial, non- talerised red altisols and ultisols.	Rice, sugarcane, tea.	Humid and pri-humid
Hills zone	Hilly (upto 1800 mt.) gentle to steep slope, a very small part plain.	Lateritic (altisols and ultisols) red loams (ultisols) old alluvium (altisols and ultisols)	Rice, Maize, Cotton, Wet-rice and plain crops, Millets, Maize	Humid and sub-humid.

Source: "Field Manual for Rainfed Agriculture in Assam" by Borthakur et al.

area of the state and 3.50 per cent of the total population of the state. These zone have three important fast flowing tributaries of the river Brahmaputra, though two of them is located at the east and west boundary of the district. It is high rainfall zone with more than 2000 mm per annum and humidity is more than 80 per cent. The maximum temperature rises up to 36^0 C in July and August and the minimum falls is 6^0 C in January. Rice is the predominant crop whereas tea is a main commercial crop which is extensively grown on the slopes.

1.3.2. SOCIO-ECONOMIC SETTING

The entire study area is covered three broad sub- division i.e., Jorhat, Titabor, and Majuli. Due to the development of tea industry, different small scale industries, favourable tourism, pleasant climate, fertile soil, smooth bio-diversity, the people from different parts of India access towards it. Therefore, there are concentric inhabitation by Assamese and non Assamese, and tribal and non- tribal people.

1.3.2.1. POPULATION DISTRIBUTION AND DENSITY

The most significant influence on the socio-economic development of agricultural peasants is population. Due to increasing population, there is always problem that affect the entire economy related to agriculture. According to 1991 census, the population of the Jorhat district was 871,206 which have been constantly increased up to 999,221 persons in 2001. According to the 2011 census, the population of the Jorhat district is being increased to 1,091,295 constituting male population of 556,805 and female population 535,451.[17] The increasing rate of population directly affect on farming system of agriculture.

The district has a population density of 383 inhabitants per square km. (990/sq.ml.) according to 2011 census. Its population growth rate over the decade 2001-2011 was 9.31 per cent. The SC and ST population of the district is 7.61 per cent and 12.09 per cent respectively of the total population. However, the Majuli sub-division has a tribal population of 70 per cent who are primarily Misings.

[17] District Census Handbook, 2011, Jorhat, Assam.

POPULATION DISTRIBUTION GRAPH

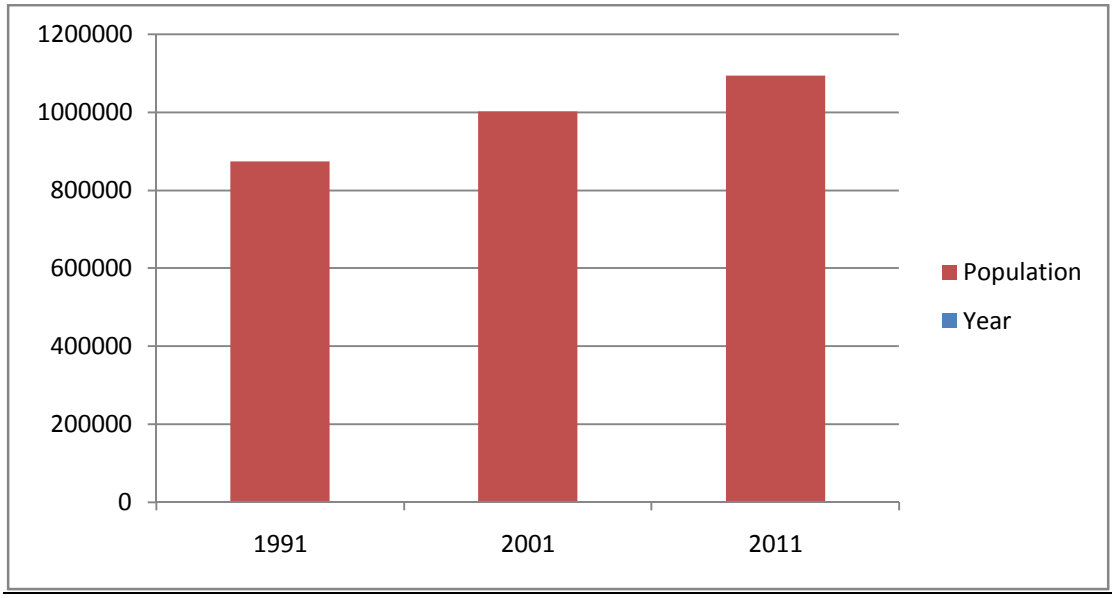

FIG 1.10

1.3.2.2. AGE COMPOSITION AND SEX RATIO

For the eminent of the study, the different age group is being categorized. According to 2011 census, the sex ration of Jorhat is 955 females per 1000 male. The data about the age group and sex ration of last few decades in Jorhat district are given below-

Table 1.4

AGE COMPOSITION AND SEX RATIO

Age Group	Total Population T.P/Yea					
	T.P=1,092,256 (2011)		T.P=999,221 (2001)		T.P=871,206 (1991)	
	Male	Female	Male	Female	Male	Female
0-25	222722	214180	206806	192882	182836	165646
25-45	167042	160636	155105	144662	137127	124235
45-60	111361	107090	103403	96441	91418	82824
Above 60	55680	53545	51701	48221	45709	41411

Source: District Census Office, Jorhat, 2015.

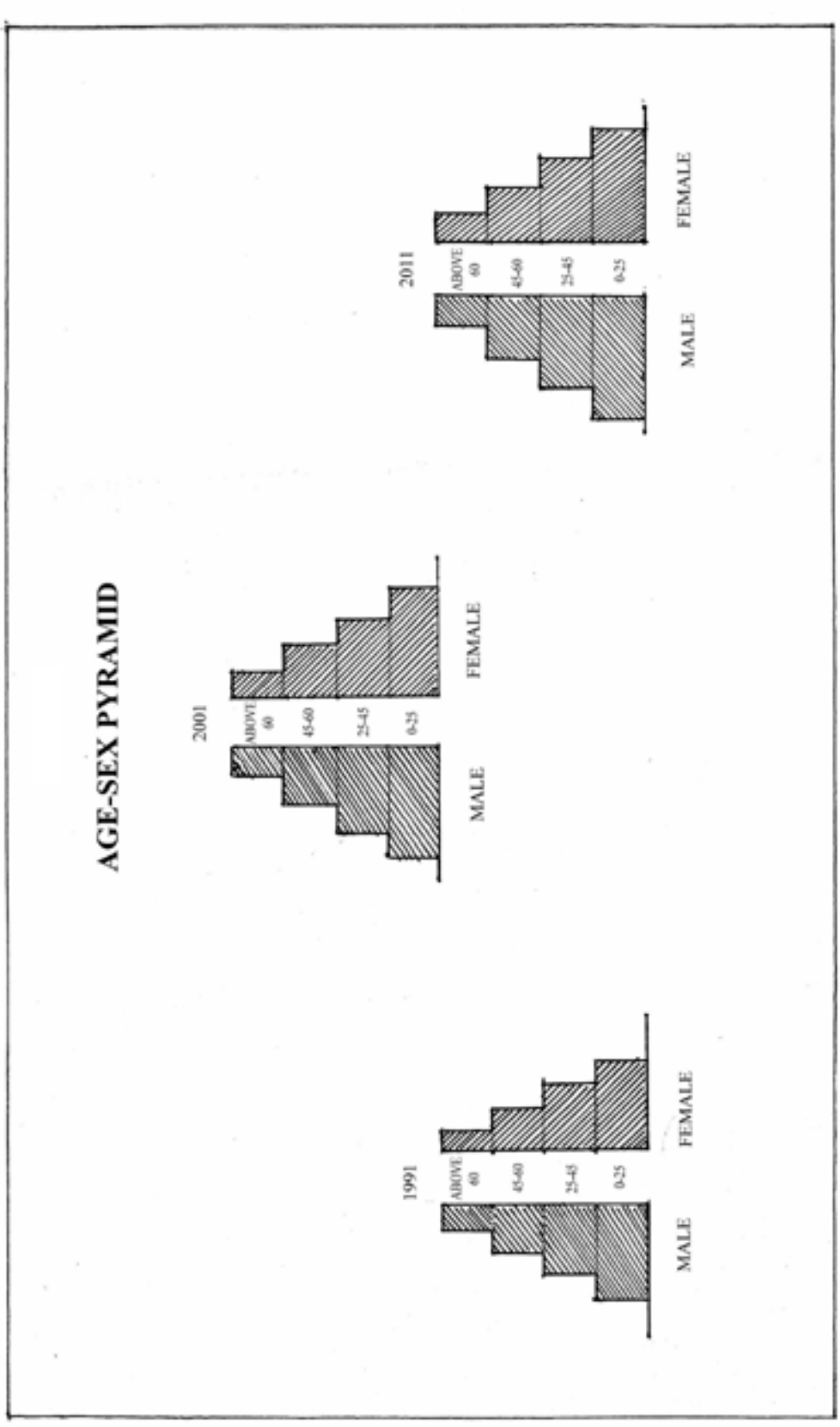
AGE-SEX PYRAMID
2001
ABOVE 60
45-60
25-45
0-25
MALE
FEMALE
2011
ABOVE 60
45-60
25-45
0-25
MALE
FEMALE
1991
ABOVE 60
45-60
25-45
0-25
MALE
FEMALE

FIG 1.11

From the above table, it is revealed that the number of female is less when compared to the male. However, it is noticed that year wise, the difference between male and female are decreasing in order.

1.3.2.3. RELIGION

Believers of different types of religions are found in the entire study area. Hindu, Muslim, Christian, Sikhs, Jains etc., all of these, Hindus have the largest population in this area. The second is the Muslims and remaining others are found as minor religions. The percentage wise population of religion in the study area is given below.

Table 1.5

RELIGIOUS COMPOSITION

Categories of Religions	Percentage of the total population
Hindu	79.44
Muslim	12.80
Christian	3.60
Buddhist	3.64
Others	1.87

Source: Field Survey, 2015.

RELIGIOUS COMPOSITIONS BY PIE DIAGRAM

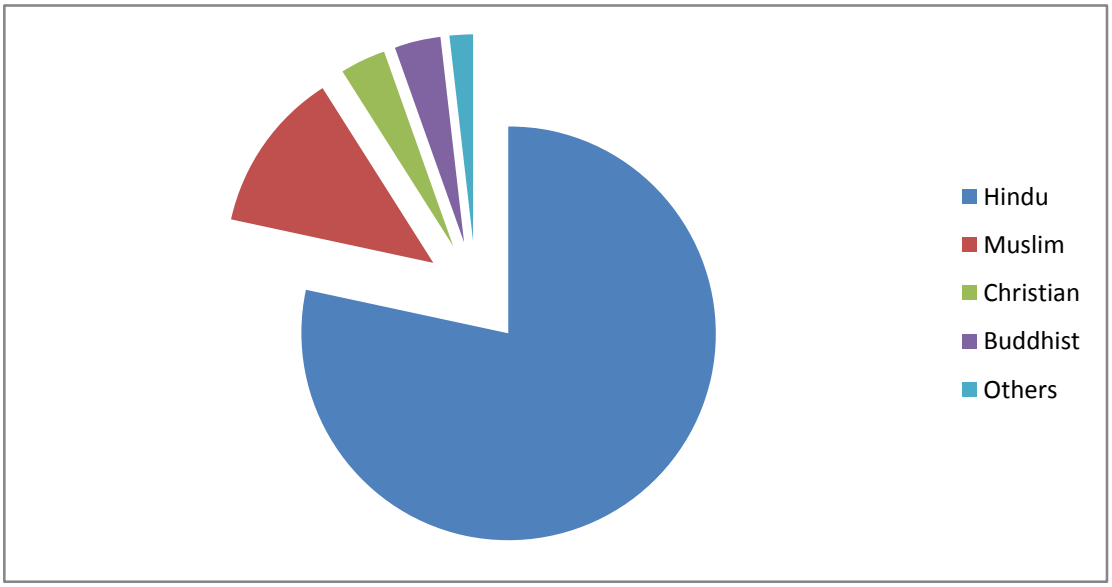

FIG 1.12

1.3.2.4. CASTE AND COMMUNITY

Like religion, there are different types of community and each community has also different caste. They are mainly Assamese, Bengali, Oriya, Bihari, Rajasthani, Tamil, and Telegu etc. Compositions of communities are not only of Indian origin, other communities like Nepali, Pakistani, Bangladeshi etc., are already settled in the study area.

1.3.2.5. LANGUAGE

The primary language of Jorhat district is Assamese. Besides, some other languages like Hindi, Bangla, Nepali, Oriya, Nagamese, English etc., are also spoken by the people in the district. Also the tribal people use to speak their own language (duwan) within their community.

1.3.2.6. EDUCATION AND LITERACY

Jorhat is considered the most literate district of Assam. The Jorhat government Boys school is the oldest school established in 1883 with special facilities for science teaching. The Jaganath Barooah College is the oldest college of upper Assam circle which is set up in 1930. Besides these, many schools and colleges are available within the entire district. Jorhat is the seat of learning with a first and only agricultural university is the whole N.E. region i.e., Assam Agriculture University established in 1948. In addition to the Jorhat Engineering College (1960), North East Institute of Science and Technology (NEIST, 1961), Prince of Wales Institute of Engineering and Technology (POWIET, 1926), Tocklai Tea Research Institute (1911), Jorhat Medical College and Hospital (2009), Kaziranga University (2012) etc., are some of the noted educational institutions.

The literacy rate of the Jorhat district is highest among the other districts of Assam. According to 2011 census, the literacy rate of the district is 83.42 per cent.[18] Although the high literacy and sufficient educational facilities are available within the district, the development of agriculture is still unsatisfactory.

[18] Ibid.

1.3.2.7. AGRICULTURE

The agricultural crops of the district can be divided into three broad categories- plantation crops, horticulture crops and food crops. The plantation crop of the district is tea plantation. There are about 135 tea gardens, including out gardens. The main horticulture crops of Jorhat district are- sugarcane, banana, lemon, orange, pineapple, ginger, turmeric, chilli, blackberry, battle nut etc. The predominant food crop is rice with per capita food grain production of 205 kg. per annum. Other food crops are - wheat, rapeseed, green gram, black gram, potato, pea, sesame, lentil etc.

1.3.2.8. INDUSTRY

The industrial field of Jorhat district is quite significant. There is a number of small scale and cottage industries in the district. The main industries are cane work and bamboo work, silver jewelry, furniture making, brass smithy, umbrella making, soap manufacturing, packaged food manufacturing, candle manufacturing etc.

The cottage industries include the handicrafts producing materials. The main works of these are weaving coarse cotton cloth being woven. It is interesting to note that the neighbouring villagers rear the 'Muga and Ari' from which they produce valuable cloths for marketing in the state as well as national market.

Nowadays different medium scale industries are also making tremendous progress. There are some engineering and automobile parts shops and workshops in different parts of the district. The district is also rich in handloom and sawmills industries.

Tea industry is not only the mainstay of the people but also the backbone of the economy. Nearly 20 per cent of the population depends on the 135 tea garden in the district for their livelihood.

1.3.2.9. MARKET

Market is the most dominating factor for the study of socio-economic development of agricultural peasants of Jorhat district. The district is located at the

midpoint of Assam. Therefore, important trading and commercial centres are growing up in different parts of the district. The main trading and commercial centres of the district are – Alengmara, Barhola, Daflating, Garmur, Jorhat, Kamalabari, Lichibari, Madhupur, Nagabat, Na-kachari, Teok, Thengalgaon, Titabor, and Mariani. Besides, many small commercial centres are growing up in chowk of tinali and chariali, where people buy and sale goods as required.

1.4. SCOPE OF THE STUDY

Agriculture is the most important component which directly influences the economy of a country as well as a nation. In this context, it is highly needed to evaluate the effectiveness of different sectors of agriculture. It is true that almost 80 per cent people of Assam are living in villages and overwhelming majority of them depends upon agriculture. Though Jorhat district has a strong agro-climatic base area, yet its economy from peasant agricultural sector is not showing satisfactory performance. So, one of the goals is to analyze the socio-economic problem that affect the agricultural peasants. The government of Assam should introduce and initiate sufficient schemes to develop agricultural peasants.

1.5. OBJECTIVES

There are only few studies which have been conducted on socio-economic development of agricultural peasants in the Assam in general and in Jorhat district in particular. This is understandable from the context and concept of agricultural peasants in Jorhat district of Assam which significantly differs from the rest of the districts of Assam and the entire country. In the light of the new strategy adopted by the government of India during 1966-67 for agricultural development, the agricultural peasants assumed special significance in India as the unit of decision making. It became more important as the agricultural census centre among socio-economic development of agricultural peasants. The study, therefore, is undertaken with the following main objectives-

1. To study the efficiency of farms among various crops in the district as an areal unit to the total yield of the region.

2. To access the nature and extent of inequality in the distribution of landholding among various segments of the population.

3. To examine the socio-economic and technological factors along with the physical landscape of the district which are closely related to the agricultural productivity under different agro-climatic conditions.

4. To examine the specific nature of the relationship between the pattern of farm size and productivity in the study region.

5. To analyse the basic relationship between the input and output variables and study various programmes on agricultural planning and policies and suggest necessary reformative measures aiming at better productivity on land.

1.6. HYPOTHESIS

In order to achieve the above objectives the following hypothesis were proposed and an attempt has been made to test these hypothesis in the course of this research work –

1. The farm sizes are uneconomic with little capacity of extension which acts as a critical limiting factor for the agricultural growth in the district.

2. Traditional mode of agriculture is vulnerable to various natural calamities.

3. Less impact of Green Revolution is having more advantage to the small size farmers rather than the big farms.

4. Smaller the farm size in the region, the more is the misuse of family labour.

1.7. METHODOLOGY

Despite the fact that Jorhat is rich in various mineral and other resources, the economy of the district is still based on agriculture. Though the district is one of the best agricultural region in the state, its agriculture is in subsistence level and farmers are economically very poor.

Although Assam Agricultural University has been established in the district and a number of research works, planned programmes and schemes have been undertaken and carried out, there is still a big gap between agricultural peasants and agricultural reformers. Therefore, it is inevitable to have an analysis of the very structure of the whole system before taking any kind of innovative schemes.

Systematic methodology is the key of success of any research project as it has direct bearing on the relevance of research findings. Specially in the case of social research. It is essential to adopt some pattern of standard procedure which is designed for a particular practice.

With this end in view and to achieve the objectives, the present study has been completed through field survey, direct observation, collection of secondary data from blocks, district headquarters, different library and institutions, other available sources, planned and designed within an environmental-cum-socio-economic framework.

The data used for the study are being obtained from both secondary and primary sources through field survey. The main source of the secondary information had been taken from published and unpublished reports on agriculture, Government of Assam. Apart from this sources information were being obtained from reports on agricultural census and other sources i.e., books, reports, journals, magazines and newspapers. The required primary data for the study is being gathered during field survey by personal visit of the area. All the sample households of farm families of different size group were being interviewed by structured scheduled and set of questionnaires. The information provided by the respondents of the sample households were being verified by cross questioning and also with the help of the knowledgeable elderly persons of the villages. Thus the primary data have been analyzed through the sampling design. The study has been conducted within eight development blocks from three sub-divisions. A total of 200 peasants sample families have been taken into consideration of different farm size classes.

Field survey was conducted with the help of comprehensive questionnaire by house to house enumeration basis of selected 200 peasants' families. After data

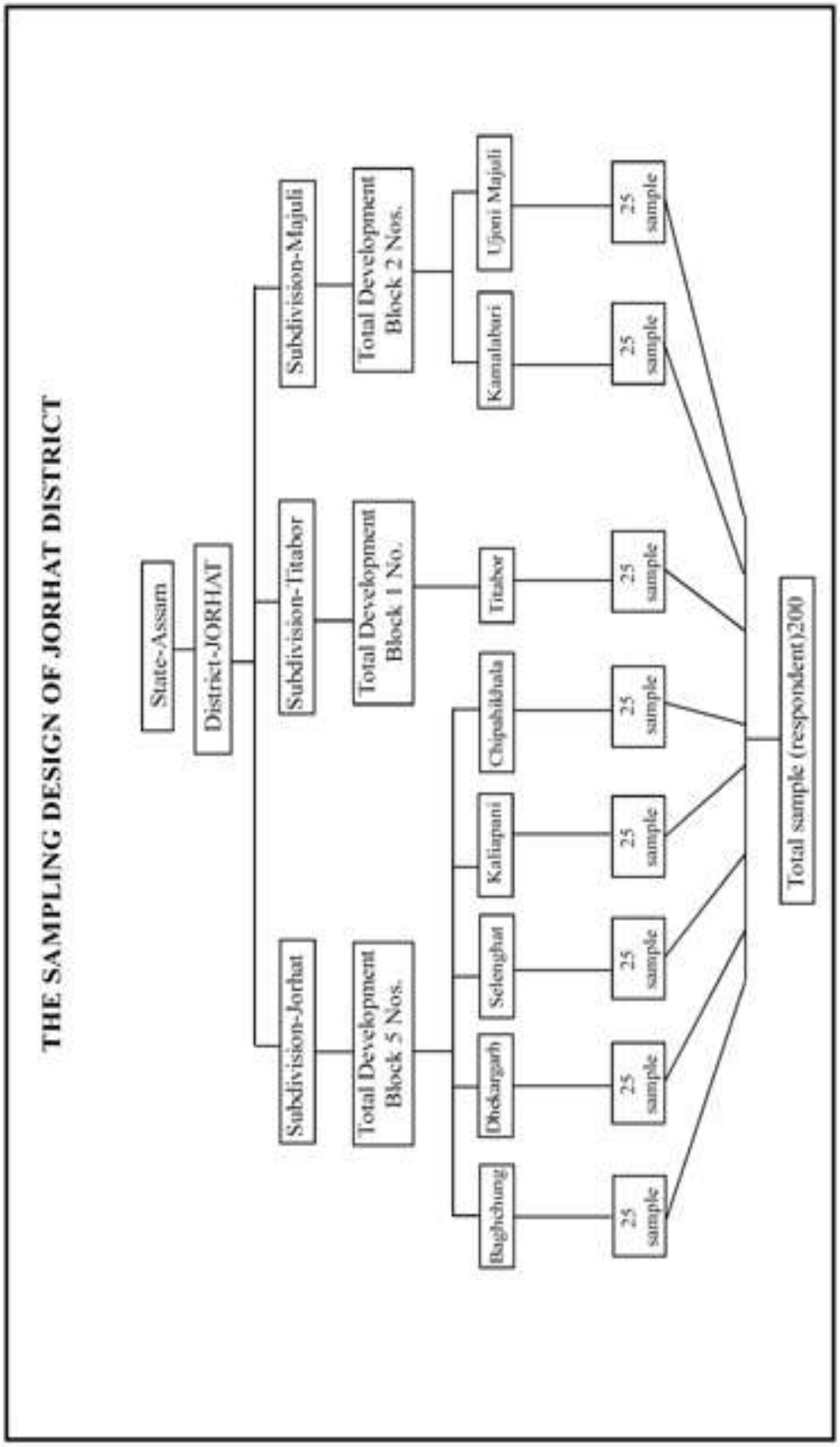
THE SAMPLING DESIGN OF JORHAT DISTRICT
State-Assam
District-JORHAT
Subdivision-Jorhat
Subdivision-Titabor
Subdivision-Majuli
Total Development Block 5 Nos.
Total Development Block 1 No.
Total Development Block 2 Nos.
Baghchung
Dhekargarh
Selenghat
Kaliapani
Chipahibhala
Titabor
Kamalabari
Ujeni Majuli
25 sample
Total sample (respondent)200

FIG 1.13

collection tabulation was done and farm sizes were classified into 5 different groups. This classification on the basis of farm size groups are conforms to the land classification prescribed by the Farm Management Survey of India.

For interpretation of the results of production operations and to establish the relationship between different assets of agriculture i.e., farm size and productivity, productivity and inputs variables, the output of principal crops have been considered for preparing the productivity index. Agricultural productivity per hectare is calculated by converting the total production of various crops into money value. Similarly, three major inputs viz. labour, draught animals and non-land capital (Agricultural technology) have been also calculated by converting into money value.

The relation between the two i.e., input and output have been calculated by using "Multiple Regression Model" of the following form-

$$Y = B_1X_1 + B_2X_2 + B_3X_3 \text{ ----------} \infty$$

Where, Y is the production per hectare.

X_1 X_2 X_3 are the production variables.

B_1 B_2 B_3 is the co-efficient of the model.

And ∑ is the origin point of line.

The regression results have been tested by using Rank Difference Method of correlation of coefficient (Rho) between output and different inputs separately, viz. productivity and non-land capital, productivity and labour input, productivity and animal inputs etc. The distribution of population attributes and inputs variables are also depicted by the scatter diagram.

1.8. CHAPTERISATION

Keeping the broad frame of work in view, the study is organized into six chapters-

The first chapter provides the research setting with reference to the objectives of the study, methodology adopted, hypothesis, organization of the chapters and

review of literature. It also gives a brief description of the study area with two broad divisions i.e., physical and socio-economic settings.

The second chapter is descriptive and analytical account of the farm efficiency with land-use classification, comparison to the district with state and also its changes and variation over the last ten years. This chapter also emphasized on the existing cropping pattern of the study area.

The third chapter makes an attempt to study the land-holding pattern of the study region. The important land reform measures in the region since independence, land tenure system since Ahom kingdom are being discussed. It also explains caste wise and block wise distribution of land holding pattern in Jorhat district.

The fourth chapter pertains to the study of the existing agricultural production of the district. It deals with the various factors as physical and biological factors, socio-economic-cultural complexes, technology and infrastructural needs.

The fifth chapter emphasizes on different farm assets, like farm size, agricultural production, fragmentation, ownership of farms, animal inputs, labour inputs, non-land capital inputs etc. This entire chapter is based on primary data and it has attempted to show the relationship between inputs and output variables. At last, different tests are made to prove the relationship.

The sixth and final chapter presents a brief summary of the findings and conclusions of the study.

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CHAPTER II

FARM EFFICIENCY

2.1 INTRODUCTION

Nearly 50 per cent of the world labour force is employed in agriculture. Distribution in the late 1980's ranged from 64 per cent of the economically active in Africa to less than 4 per cent in America and Canada. In Asia the figure was 61 per cent, South America 24 per cent, Eastern Europe and Russia 15 per cent, Western Europe 7 per cent. Understanding Efficiency tree, many people believe that agriculture in these countries are getting more and more efficient. They perhaps get this impression on account of the fact that yields of crops are going up all the time. They may also be influenced in their thinking by the fact that farming is getting increasingly mechanised and requires less and less labour. Nowadays one person can farm hundreds of acres of arable land, whereas fifty years ago they might only be able to farm twenty acres. But these facts do not in any way indicate greater efficiency. No doubt, agricultural production has increased enormously in the last half century, but efficiency has actually gone down over the same period.[19]

This apparent paradox arises because of a misunderstanding about the meaning of the word efficiency. It has nothing to do with productivity. The efficiency of a system means the ratio between the work or energy go out of it and the work or energy put into it. The more energy we get out per unit amount we put in the more efficient the system is. Theoretically, the maximum efficiency is when the energy put in is equal to the energy got out- such a system has an efficiency of 1 (or 100%). But in practice it is impossible to have efficiency as high as 1, because that would mean a perfect mechanism which had no energy losses at all. [20]

Calculating energy in agricultural systems the energy inputs are of two kinds. On one hand this is the sun's energy, which is absolutely necessary for plant growth and which is virtually inexhaustible, freely available and generally beyond our control.

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[19] Bayliss Smith, T.P.,(1982), *The Ecology of Agricultural System*.

[20] Uhlin, Hans – Erik, (1997), "Why energy productivity is increasing an 1-0 analysis of Swedish agriculture", Agricultural System, vol-56, p.4.

On the other hand there is all the rest of the energy used, usually referred to as the support energy, which is under our control, has a cost and is exhaustible. [21]

This support energy consists of such things as the energy used by people and draught animals in their work, the energy used to manufacture farming tools and machinery, the energy used by the chemical industry to produce the fertilisers, pesticides, herbicides, plastics etc., the energy used in food processing and the fuel used in transport the produce to the consumer.

Not all of this energy input is taken into consideration in comparing the efficiency of different food production system. The sun's energy is usually left out of the calculation, because it is assumed that in a given place it is constant, whatever the farming methods being used. Labour energy is sometimes left out as being negligible. Energy consumed in processing food and transporting it to the consumer is normally left out because it is not considered relevant. Only energy consumed within the boundaries of the farm is put into the calculations.[22]

In this chapter, it is convenient to leave out all of them apart from a nominal value for cropping pattern and agricultural land use on a simplified index of agricultural efficiency, which is the ratio of the energy of the crop produced in different cropping pattern, to the energy consumed on the agricultural land which is used to produce them.

Land use is the human use of land. It involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods. It also has been defined as the total of arrangements, activities and inputs that people undertake in a certain land cover type to produce change or maintain it.[23] A more inclusive definition of land use in any given area of land is usually used to satisfy multiple objectives or purposes.

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[21] Steinhart, J.S. and Steinhart, C.E. (1974)," Energy history of the U.S. food system, Science", vol. 184.
[22] Leach, G. (1976), *Energy and Food Production.*
[23] IPCC Special Report on Land Use, "Land-Use Change and Forestry,2011".

Land use practices vary considerably across the world. The United Nation Food and Agriculture Organization water development division explains that land use concerns the products or benefits obtained from use of the land as well as the land management actions (activities) carried out by humans to produce those products and benefits.[24] As of the early 1990's about 13 per cent of the earth was considered arable land, with 26 per cent in pasture, 32 per cent forests and wood land, and 1.5 per cent urban areas.

Cropping pattern is the pattern of crops for a given piece of land or cropping pattern means the proportion of area under various crops at a point of time in a unit area or it indicated the yearly sequences and spatial arrangements of crops and follows in an area. The crop statistics published by the governments are used to denote the cropping pattern. It is however, a dynamic concept as it changes over space and time.

The cropping patterns of a region are closely influenced by the geo-climatic, socio-cultural, economic, historical and political factors. The physical environment (physiographic, climate, soils and water) imposes limits on the growth and distribution of plants and animals. The availability of this physical environment has to be evolved for realizing the potential production levels through efficient use of available resources. The cropping pattern should provide enough food for the family, fodder for cattle and generate sufficient cash income for domestic and cultivation expenses. This objective could be achieved by adopting intensive cropping. Method of intensive cropping includes multiple cropping and intercropping. Intensive cropping may base some practical difficulties such as shorter turnaround time lapse for land preparation before the succeeding crops and labour shortage at peak agricultural activities. These problems can be overcome by making modification in the cropping techniques. Alteration in crop geometry may help to accommodate intercrops without losing the base crop production.[25]

The role of man in the cultivation of certain crops in a region is also quite important. Man, by his technological advancement, can ameliorate the physical

[24] "FAO Land and Water Division", Retrieved 14 September, 2010.
[25] Current Category: "Farming Systems and Sustainable Agriculture". (Internet).

limits. Depending on the terrain, topography, slope, temperature amount and reliability of rainfall, soils and availability of water for irrigation, the cropping pattern vary from region to region. The perception and assessment of environment also guide to grow certain crops in a region. Those areas of the world where physical diversities are less, the cropping patterns are less diversified. For example, in the rainfall deficient areas of Rajasthan, the farmers grow bajara (bulrush, millet), while in the Brahmaputra valley of Assam, rice is the dominant crop.

Moreover, the land tenancy, ownership of land, size of holdings and size of fields also impose restrictions on the cropping patterns of a region. In the areas of small holdings, the farmers tend to be subsistent despite innovation diffusion. Contrary to this, the farmers with large holdings have more risk bearing capacity and they have relatively high degree of commercialization.

2.2 EFFICIENT CROPPING PATTERN

Efficient cropping pattern for a particular farm depend on land resources, land enterprises and land technology because farm is an organized economical unit. The land resources include land, labour, water, capital and infrastructure. When land is limited intensive cropping is adapted to fully utilized available water and labour when sufficient and cheap labour is available, vegetable crops are also included in the cropping pattern, as they required more labour. Capital intensive crop like sugarcane, banana, turmeric etc., find a space in the cropping pattern when capital is not a constraint. In low rainfall regions (750mm/annum) mono cropping is followed and when rainfall is more than 750 mm, inter cropping is practiced, with sufficient irrigation water, triple and quadruple cropping is adopted, when other climatic factors are not limiting farm enterprise like dairing, poultry etc., also influenced the type of cropping system. The feasibility of growing for crop sequences in genetic alluvial plains input to multiple cropping. [26]

The efficient cropping patterns of a region or areal unit may be determined on the basis of areal strength of individual crops. The first, second and third ranking crops of an areal unit may be called as the dominant crops of that unit. These crops if

[26] Ibid.

occupying more or less the same percentage of the total cropped area shall be competing for area with each other and the farmer will decide which crop may fetch him more profit in a given year under the prevailing rainfall and demand, supply and commodity price condition.

Apart from the proportion of area under a particular crop, its relative yield also guides the efficiency of that farm crop in a given geo-climatic and cultural setting. The relative yield index and the relative spread index for the determination of efficiency of farm crop may be calculated by applying the following formula:

$$\text{RYI} = = \frac{Y_0}{Y_{\max}} \times 100$$

Where, RYI = Relative Yield Index

Y_0 = Mean yield of the crop in a component areal unit

Y_{max} = Mean Yield of the total area

On the basis of this index the efficiency of the farm crop grown in a region may be ascertained. If the relative yield is below 90%, then it may be an inefficient farm. [27]

2.3 LAND-USE AND CROPPING PATTERN

Land use and cropping patterns are the extent to which the arable land under different agricultural activities can be put to use. These largely depend upon the socio-economic influents which determine the possibility of the enterprise the farmer chooses and the input intensity with which he farms. With an assured supply of water and availability of modern inputs specially high-yielding varieties of seeds and commercial fertilizers- it becomes possible for the farmer to replace less profitable crops or enterprises with more profitable ones and also to enhance the intensity of the use of the available land by growing two or even three crops in the same field in a year.[28]

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[27] Hussain, M. (2014), *Geography of India*, p. 10-12.

[28] Singh, J. And Dhillon, S.S., 2002, *Agricultural Geography*, ISBN- 0-07-462421-0.

The land use and cropping patterns mosaic of any region are the outcome of geographic features, climatic variables, pedological differences, historical processes and social and economic institutions. In a given physical milieu, man as an active agent modifies the landscape, and uses it to fulfil his needs with the technology within his disposal. Hence, it is obvious that different types of living which are represented by social values and certain institutional controls create different patterns of land use within the limits imposed by different agro-physical controls.

The Ministry of Agriculture in 1950 recommended a standard classification and uniform definition of the different categories of land to be adopted by states all over India. The definition and expansion have been further revised by the committee on improvement in Agricultural Statistics for the sake of clarity and workability. The land areas geographically accessible for major uses are classified into nine broad categories.

1. Forests cover any land classed or administered as a forest under legal enactments. The area figure under grazing lands or crops within the forest are also included in the area under forests.

2. Area under non-agricultural use covers all lands occupied by settlement, road, railways, beds of streams, ponds and canals, etc.

3. Barren and uncultivable land and bare rocky outcrops of hills, plateaus, mountains, deserts etc. This land can under no conceivable circumstances be brought under cultivation, but at a very high cost, a very little proportion may be classed as uncultivable.

4. Permanent pastures and other grazing lands embrace all grazing land which may be permanent meadows and village common pastures.

5. Area under miscellaneous tree crops etc. covers all cultivable lands which are not included in the area sown, but is put to some agricultural use other than seasonal cropping.

6. Cultivable wasteland denotes land considered by present judgement as cultivable but actually not cultivated during the current year and the last few years or more in

succession. It is left untilled on account of physical, social and economic limitations. But some proportion of it could be in no conceivable circumstances be brought under tillage without reclamations such as the water logged lands.

7. Current fallow means, the land left unsown during the current agriculture year only to regain fertility and also that which remained uncropped owing to economic reasons.

8. Other fallow lands comprise all lands which were taken up for cultivation, but are temporarily unsown for a period of not less than one year or not more than five years. The reason for long fallowing may be manifold, but the significant ones are limited means of farmers, restricted and undependable supply of moisture and un-remunerative character of agriculture.

9. The net sown area represents the extent of cultivated area actually sown during the agricultural year. It may be referred to as net cropped area also. This represents the differences between the total geographical area and the sum total of area under classes.

2.4 LAND USE CLASSIFICATION

Before we take the land use classification of Jorhat district, a brief scenario of land use classification of Assam is indicated in the table below. It is seen that there is considerable area under barren and uncultivable land (1,425, 245 hectare). This land is mainly swamps and hills while swampy area can be developed for fish production, the hill could be utilized for horticulture crops specially fruits and spices production. Similar is the case with the cultivable wasteland (88,043 hectare). The category wise availability of land is indicated in the table below.

The forest area covers 25.65 per cent of the total geographical area of Assam. Though this figure is much higher than the national figure of 21.27 per cent, still it is much lower than the national target of 33.3 per cent to the total geographical area. Net area sown in Assam is 27.53 lakh hectares in 2011-12 which has been steadily increasing since 1981-82. In 1981-82 and 1991-92 were 24.58 lakh hectares and 27.05 lakh hectares respectively.

Again a considerable increase has been observed in area sown more than once. The area sown more than once was recorded 7.54 lakh hectares in 1981-82 which rises up to 12.04 lakh hectares in 2011-12. This may be due to the pressure on agriculture as population growth is very high against a little scope of further extension of arable land into cultivable land.

Table 2.1

LAND USE CLASSIFICATION OF ASSAM, 2011-12

Sl.No.	Classification	Area in Hectare	P.C
1.	Total Geographical Area	78,44,670	
2.	Forests	20,12,449	25.65
3.	Land not available for cultivation		
	(a)Land put to non-agricultural use	10,30,060	13.13
	(b)Barren and uncultivable land	14,25,245	18.17
4.	Other uncultivable land		
	(a)Permanent pasture and other grazing land	1,58,164	2.02
	(b)Land under miscellaneous tree crops		
	(c)Cultivable waste land	2,09,964	2.68
		88,043	1.12
5.	Fallow land		
	(a)Fallow land other than current fallow	81,642	1.04
	(b)Current fallow	85,427	1.09
6.	Net area sown	27,53,676	35.10
7.	Total cropped area	39,57,082	50.44
8.	Area sown more than once	12,04,000	15.35

Source: Statistical Hand Book of Assam, 2015.

If the total 1.67 lakh hectares of fallow land and 0.88 lakh hectares of cultivable waste land are brought under cultivation, the total net sown area can be extended up to 30.08 lakh hectares against the present net sown area of 27.53 lakh hectares. In 2011-12 the total cropped area of Assam is 39.57 lakh hectares including

the area sown more than once, against the 34.60 lakh hectares in 1981-82, 36.07 lakh hectares in 1991-92.

Table 2.2

LAND USE CLASSIFICATION OF JORHAT DISTRICT, 2011-12

Sl.No.	Classification	Area in Hectare	P.C
1.	Total Geographical Area	285,200	
2.	Forests	28,540	10.01
3.	Land not available for cultivation		
	(a)Land put to non-agricultural use	71,700	25.14
	(b)Barren and uncultivable land	27,800	9.75
4.	Other uncultivable land		
	(a)Permanent pasture and other grazing land	4,400	1.54
	(b)Land under miscellaneous tree crops		
	(c)Cultivable waste land	6,700	2.35
		41,570	14.58
5.	Fallow land		
	(a)Fallow land other than current fallow	11,623	4.07
	(b)Current fallow	23,247	8.15
6.	Net area sown	69,620	24.41
7.	Total cropped area	152,900	53.61
8.	Area sown more than once	39,300	13.78

Source: Office of the district Economics & Statistics, Jorhat, 2015.

The forest area covered 28.54 thousand hectare of the total 2.85 lakh hectare of geographical area of Jorhat district which is 10.01 per cent to the total area of the district in the year 2011-12. Land not available for cultivation which includes (a) land put to non- agricultural use, and (b) barren and uncultivated land, accounted for 25.14 per cent and 9.75 per cent respectively to the total geographical area of the Jorhat district.

Other uncultivable land which includes (a) permanent pasture and grazing land, (b) land under miscellaneous tree crops and grooves, and (c) cultivable waste

land are 4.4 thousand hectares, 6.7 thousand hectares, and 41.57 thousand hectares which are about 1.54 per cent, 2.35 per cent, and 14.58 per cent respectively to the total geographical area of the district.

Land under fallow, both (a) fallow land other than current fallow and (b) current fallow are 11.62 thousand hectares and 23.25 thousand hectares which are 4.07 per cent and 8.15 per cent respectively to the total area of the district.

The net area sown of Jorhat district is 69.62 thousand hectares, which is 24.41 per cent of the total geographical area of the district. On the other hand, area sown more than once is recorded 39.3 thousand hectares which is 13.78 per cent to the total area. In 2011-12, the total cropped area of the district was 1.52 lakh hectares which is 53.61 per cent of the total geographical area of the district.

If the other cultivable land including cultivated waste land is brought under cultivation, the total cropped area could be extended up to 1.94 lakh hectares which would be 68.19 per cent to the total geographical area of the district. In the same manner, fallow land i.e., other fallow and current fallow, if it will consider under cultivation, the total cropped area will be extended up to 1.88 lakh hectares.

Table 2.3

PERCENTAGE WISE LAND USE CLASSIFICATION OF JORHAT DISTRICT

(COMPARISION WITH ASSAM IN 2011-12)

Sl.no.	Land Use Classification	Jorhat (% of total area)	Assam (% of total area)
1.	Total Geographical Area	2, 85,200 hec.	78, 44,670 hec.
2.	Forest Area	10.01	25.65
3.	Land not available for cultivation	34.89	31.30
4.	Other uncultivable land	18.47	5.82
5.	Fallow land	12.22	2.13
6.	Net area sown	24.41	35.10
7.	Area sown more than once	13.78	15.35
8.	Total cropped area	53.61	50.44

Source: Statistical Hand Book of Assam, 2015.

LAND USE PATTERN OF JORHAT DISTRICT AND ASSAM

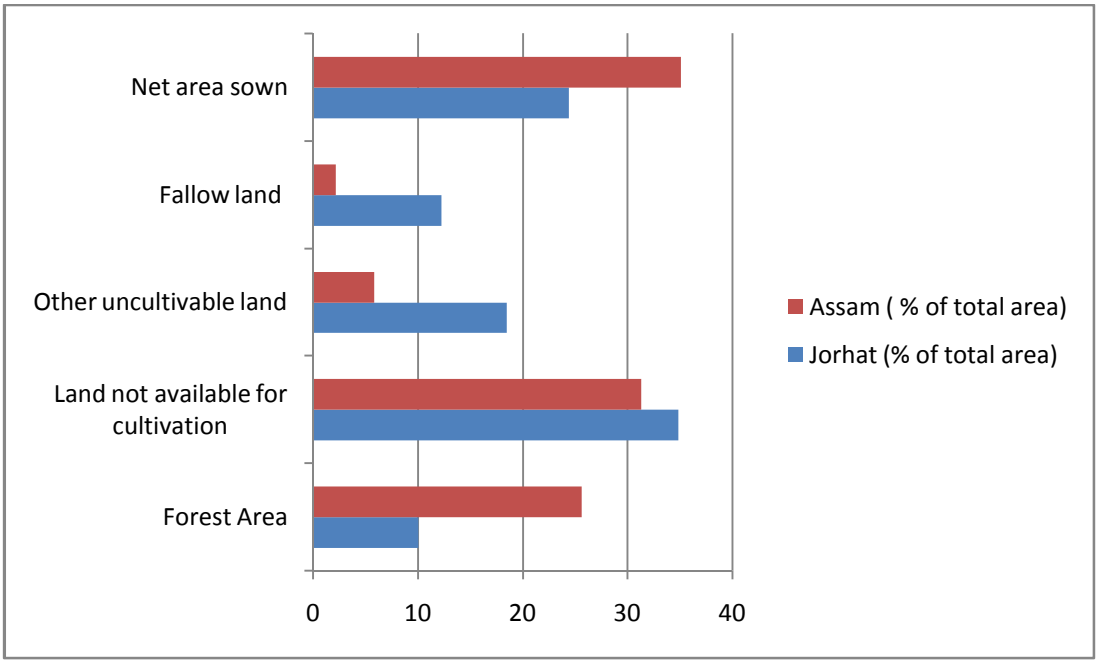

FIG 2.1

The forest area covers 10.01 per cent of the total geographical area of Jorhat district. Though this figure is much lower than the state figure of 25.65 per cent, still both the district and state are much lower than the national target of 33.3 per cent to the total geographical area.

The percentage of land not available for cultivation is 34.89 per cent which is higher than the state target recorded 31.30 per cent. This is because of the miles of flood plain zone of the both bank of river Brahmaputra. Moreover, a huge area of the district is under the foot hill zone of Naga Hills, the hillocks are the barrier for cultivation.

The other uncultivable land and fallow land of the district is 18.47 per cent and 12.22 per cent which is much higher than the state percentage of 5.82 per cent and 2.13 per cent respectively. On the other hand net area sown is 24.41 per cent which is much lower than the state target of 35.10 per cent. This figure is steadily decreasing in the district since 1981-82. This may be due to the pressure on agriculture as population growth is very high against a little scope of further extension of arable land into cultivable land.

Table: 2.4

BLOCKWISE LANDUSE PATTERN OF JORHAT DISTRICT, 2015-16

(Area in 00' hectares)

Sl.no.	Name of the Block	Geographical Area	Cultivated Area	Cultivable Area	Current Fallow	Forest	Pasture	Land put to non-agricultural Use	Misc. Plantation	Barren uncultivable land (waste land)
01.	Titabor	470.38	64.39	320.17	20.00	132.64	2.02	40.00	19.37	11.00
02.	Selenghat	194.00	143.40	155.74	21.00	11.05	2.21	130.00	3.82	10.00
03.	Kaliapani	228.63	139.78	164.62	14.00	11.07	10.08	15.00	7.68	10.00
04.	Chipahikhola	207.97	149.94	155.36	18.00	20.98	0.75	140.00	1.26	15.00
05.	Baghchung	450.64	283.38	361.65	12.00	1.70	12.78	47.00	2.06	19.80
06.	Dhekorgorah	307.00	168.00	170.55	168.00	110.00	10.85	110.00	19.12	70.00
07.	Ujoni Majuli	469.27	96.77	99.96	55.00	46.89	2.07	50.00	5.12	70.50
08.	Kamalabari	454.11	68.36	100.95	40.00	58.50	3.30	50.00	8.37	171.70

Source: Director of Economics and Statistics, Jorhat.

But the total cropped area and area sown more than once in the Jorhat district and state figure is almost equal. The total cropped area of Jorhat district is 53.61 per cent and the state figure is 50.44 per cent and the area sown more than once of the district figure is 13.78 per cent and the state figure is recorded 15.35 per cent.

2.5 CROPPING PATTERN

Agricultural land use in Jorhat district is characterised by comparatively low percentage of cultivable land. A large number of crops are grown in the district, but only a few of them are significant in the aggregate level. Among the various food grains, rice in the main dominating crop of Jorhat district as well as the state of Assam. It is grown in almost all the districts of Assam. They are winter rice (Sali and Bao), summer rice (Ahu) and autumn rice (Boro). Among these three, winter rice is grown extensively.

Total area under rice cultivation in Assam in 1950-51 was 15.1 lakh hectares and it is increased up to 19.74 lakh hectares in 1970-71. Similarly, 22.75 lakh hectares in 1980 -1981, 23.24 lakh hectares in 1985 - 86 and 25.94 lakh hectares in 1990 - 91.

The table 2.5 and 2.6 show the area, productivity, and yield under different food grains and non food grain crops of Assam in the last eleven years i.e. 2004-05 to 2014-15.

Rice is the dominant crop of Assam. In 2012-13, its production has been increased to 3319.0 thousand tonnes and its productivity was 1.43 tonnes/hectare. In 2013-14, the state production rises up to 4008.0 thousand tones and its productivity was 1.61 tonnes/hectare, it rises up to 4408.0 thousand tonnes production and yield 1.74 tonnes/hectare in 2014-15. But the area in lakh hectare decrease since last four years due to the pressure of population on land.

Wheat is the second important food grain in Assam. However, the area under wheat cultivation is confined to few districts of the state and it is negligible. The figure of 2014-15 shows that there are 0.60 lakh hectares of land under wheat cultivation as compared to 0.50 lakh hectares in 2013-14. In the same manner

Table: 2.5

MAJOR CROPS IN ASSAM DURING 2004-05 TO 2014-15

(A: Area in lakh hectares, P: Production in '000 tonnes, Y: Yield in tonnes/hectares)

Year	Rice			Wheat			Maize			Pulse		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
2004-05	25.77	3762.0	1.46	0.68	87.7	1.29	0.199	14.0	0.70	1.10	61.0	0.55
2005-06	26.46	3998.4	1.53	0.70	85.7	1.22	0.202	14.6	0.72	1.11	62.9	0.56
2006-07	25.37	3854.0	1.52	0.72	85.0	1.18	0.196	13.9	0.71	1.18	66.0	0.56
2007-08	25.40	3738.0	1.47	0.69	78.0	1.13	0.198	14.2	0.72	1.11	60.0	0.54
2008-09	25.29	3880.0	1.53	0.70	73.0	1.04	0.196	14.1	0.72	1.14	63.0	0.55
2009-10	23.83	3470.0	1.46	0.64	68.0	1.06	0.192	14.0	0.71	1.08	61.0	0.59
2010-11	24.20	3552.0	1.47	0.50	54.0	1.08	0.189	13.7	0.73	1.00	56.0	0.55
2011-12	21.89	2916.0	1.33	0.60	67.0	1.12	0.187	13.6	0.74	1.07	59.0	0.56
2012-13	23.24	3319.0	1.43	0.56	71.0	1.27	0.183	13.3	0.73	1.13	61.0	0.56
2013-14	24.84	4008.0	1.61	0.50	55.0	1.10	0.185	13.7	0.74	1.14	62.0	0.55
2014-15	25.30	4408.0	1.74	0.60	65.0	1.08	0.201	14.0	0.72	1.19	66.0	0.56

Source: Statistical Hand Book of Assam, 2015.

Table: 2.6

MAJOR CROPS IN ASSAM DURING 2004-05 TO 2014-15

(A: Area in lakh hectares, P: Production in '000 tonnes, Y: Yield in tonnes/hectares, Jute production in '000 bales)

Year	Rape seeds & Mustard			Jute			Potato			Sugarcane		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
2004-05	2.98	134.1	0.45	0.68	656.8	9.66	0.79	649.4	8.22	0.26	956.8	36.8
2005-06	3.10	159.9	0.52	0.69	668.1	9.61	0.80	652.5	8.25	0.27	959.7	36.9
2006-07	2.99	151.0	0.51	0.68	974.6	9.89	0.80	620.6	7.78	0.27	1011.4	37.2
2007-08	2.87	144.0	0.50	0.68	690.6	10.2	0.75	589.9	7.82	0.25	916.1	36.4
2008-09	2.89	152.0	0.53	0.64	665.1	10.4	0.78	543.1	6.97	0.25	981.4	38.6
2009-10	2.68	142.0	0.54	0.58	410.4	7.06	0.77	531.3	6.90	0.24	883.9	23.9
2010-11	2.35	110.0	0.46	0.57	578.8	10.2	0.69	353.6	5.08	0.23	871.2	23.4
2011-12	2.60	129.0	0.51	0.577	558.6	9.67	0.78	504.6	6.49	0.25	1055.3	39.6
2012-13	2.56	135.0	0.49	0.598	656.8	10.9	0.79	514.6	6.51	0.26	979.9	38.0
2013-14	2.57	137.0	0.55	0.601	647.5	10.7	0.78	515.7	6.58	0.29	1099.7	38.4
2014-15	2.69	142.0	0.53	0.65	713.0	10.9	0.80	528.0	6.60	0.27	1062.0	39.1

Source: Statistical Hand Book of Assam, 2015.

production also increase in last two years i.e. 55 thousand tonnes and 65 thousand tonnes in the 2013-14 and 2014-15 respectively.

Mustard seed is the main oilseed crop and it is the second largest crop of Assam in terms of area. The area under mustard cultivation is 2.56 lakh hectares in 2012-13 and it increased to 2.57 lakh hectares in 2013-14 and 2.69 lakh hectares in 2014-15. Traditionally, it is grown in the riparian tracts of Brahmaputra where the soil is less acidic in reaction and light. The production under mustard is 135 thousand tonnes in 2012-13 and 137 thousand tonnes in 2013-14 which is increased up to 142 thousand tonnes in 2014-15.

Jute is the main fibre crop of Assam. It is cultivated mainly in the low lying areas of the state. The area under jute cultivation in Assam is 0.598 lakh hectares and production is 656.8 thousand bales in 2012-13. The area in 2013-14 is 0.601 lakh hectares and production under jute is 647.5 thousand bales. The figure has been dramatically increased in 2014-15, the area is 0.65 lakh hectares and production is 713.0 thousand bales.

Sugarcane is the second largest crop in terms of production in Assam. Both the production and productivity has been increased since last ten years. The production under sugarcane is 956.8 thousand tonnes and productivity is 36.8 tonnes/hectares in 2005-06. The production has increased up to 1062.0 thousand tonnes and yield is being increased to 39.1 tonnes/hectares in 2014-15. Besides these, other important crops cultivated in Assam are Maize, other cereals, gram, other pulses, Linseed, Castor, Sesame, Cotton, Mesta, Tobacco, Chillies, and Potato etc.

Agricultural land use in Jorhat district of Assam is characterised by comparatively low percentage of cultivable land. The percentage of area under rice is very high as compared to the total area sown in the district but the intensity of crops and yields per unit area is very low.

A large number of crops are grown in Jorhat district. Food grains are the dominating crops in the region where it occupies as high as 76.99 per cent of the

total cropped area under field survey of the region. Oil seeds are second dominating crop in the region where it occupies 14.44 per cent of the total cropped area and under miscellaneous crop is 8.0 per cent to the total cropped area. The lowest percentage of crop is fibre crop which occupy only 0.57 per cent to the total cropped area. The total cropped area under cultivation during the field survey was 467.2 hectares. The table below shows the area (in hectare) under different crops of cultivation during the field survey of 200 peasant families.

Table 2.7

AREA IN HECTARE UNDER DIFFERENT CROPS

Sl. No.	Crops	Area in hectare	Percentage
01.	Food Grains	359.74	76.99
02.	Oil Seeds	67.42	14.44
03.	Fibre Crops	2.67	0.57
04.	Miscellaneous	37.37	8.0
Total Cropped Area-		467.2	100

Source: Field Survey in 2015-16.

Among the various crops in Jorhat district rice is the dominating crop and it is extensively cultivated in the whole region. According to the figures available for 2012-13, there is 86.6 thousand hectares of land under rice cultivation with productivity of 116.1 thousand tonnes and yield is 1.34 tonnes/ hectare. The area under rice cultivation is 86.9 thousand hectares, productivity is 139.1 thousand tonnes and yield is 1.51 tonnes/ hectare in 2013-14. The increasing rate of productivity of rice in 2014-15 is 1.59 tonnes/ hectare and production is 141.8 thousand tonnes under 89.2 thousand hectares.

Generally, three varieties of rice are grown in the district. They are winter rice (Sali and Bao), summer rice (Ahu) and autumn rice (Boro). The winter rice is grown extensively in the region by transplantation method. The summer rice locally known as ‘Ahu’ is sown in the month of February to April and harvested in August to September.

Table: 2.8

MAJOR CROPS IN JORHAT DISTRICT DURING 2004-05 TO 2014-15

(A: Area in lakh hectares, P: Production in '000 tonnes, Y: Yield in tonnes/hectares)

Year	Rice			Wheat			Maize			Pulse		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
2004-05	111.0	193.7	1.74	1.39	1.70	1.23	0.024	0.024	0.53	3.56	1.57	0.44
2005-06	91.7	164.6	1.79	1.39	1.66	1.19	0.068	0.035	0.51	2.44	0.99	0.41
2006-07	95.9	168.1	1.75	1.69	2.18	1.29	0.065	0.034	0.52	12.6	5.30	0.42
2007-08	77.8	122.2	1.57	0.76	1.00	1.32	0.022	0.011	0.50	4.42	1.84	0.42
2008-09	85.2	143.6	1.69	1.09	1.38	1.26	0.023	0.012	0.52	6.22	2.43	0.39
2009-10	81.5	134.7	1.65	0.75	0.88	1.17	0.022	0.011	0.54	4.99	2.01	0.403
2010-11	88.2	140.8	1.60	1.30	1.40	1.08	0.026	0.014	0.54	5.38	2.13	0.39
2011-12	75.1	86.6	1.15	0.34	0.47	1.38	0.017	0.009	0.53	3.71	1.33	0.59
2012-13	86.6	116.1	1.34	0.34	0.47	1.33	0.026	0.014	0.52	5.87	2.38	0.46
2013-14	86.9	139.1	1.51	0.35	0.22	0.62	0.029	0.020	0.53	5.98	2.81	0.47
2014-15	89.2	141.8	1.59	0.33	0.34	1.02	0.033	0.021	0.52	5.89	2.71	0.46

Source: Statistical Hand Book of Assam, 2015.

Table: 2.9

MAJOR CROPS IN JORHAT DISTRICT DURING 2004-05 TO 2014-15

(A: Area in lakh hectares, P: Production in '000 tonnes, Y: Yield in tonnes/hectares, Jute production in '000 bales)

Year	Rape seeds & Mustard			Jute			Potato			Sugarcane		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
2004-05	13.1	6.98	0.53	0.100	0.89	8.92	3.67	34.18	9.32	0.58	16.66	28.72
2005-06	10.4	4.32	0.42	0.113	1.09	9.61	4.08	39.83	9.76	0.42	14.22	33.78
2006-07	10.2	5.88	0.58	0.163	1.61	9.90	3.29	23.33	7.08	0.42	14.43	34.35
2007-08	08.79	6.17	0.70	0.135	1.37	10.2	1.44	8.59	5.96	0.19	6.09	32.45
2008-09	08.09	3.23	0.40	0.143	1.49	10.4	1.49	8.55	5.75	0.22	7.49	34.22
2009-10	07.23	4.13	0.57	0.109	0.77	7.08	1.32	8.01	6.09	0.21	6.64	32.39
2010-11	07.77	2.83	0.47	0.145	1.48	10.2	2.24	11.77	5.24	0.24	7.80	32.51
2011-12	08.48	5.23	0.62	0.136	1.32	9.68	1.97	10.83	5.51	0.23	7.72	33.41
2012-13	08.48	7.29	0.86	0.121	1.33	10.9	1.49	5.83	3.90	0.36	12.01	35.33
2013-14	11.4	7.69	0.67	0.142	1.51	10.6	2.03	10.72	5.29	0.37	11.34	30.89
2014-15	11.2	8.06	0.72	0.122	1.24	10.2	1.99	11.9	5.98	0.33	11.29	34.22

Source: Statistical Hand Book of Assam, 2015.

The autumn rice is sown by transplantation method provided water is available, during the month of May or June, and harvested in September or October.

Wheat is the second important food grains in the district but the area under its cultivation is negligible with its percentage to the total cropped area of the district. The area under wheat cultivation is 0.33 thousand hectares with production of 0.34 thousand tonnes and yield is only 1.02 tonnes/ hectare in 2014-15.

Mustard and Rape seeds are the second large crops in the district as far as area is concerned. The area under this crop is 11.2 thousand hectare and the production and yield are 8.06 thousand tonnes and 0.72 tonnes/ hectare respectively in 2014-15.

Sugarcane is the most important crop in terms of productivity. The yield 34.22 tonnes/ hectare under the area is only 0.33 thousand hectares and the production is 11.29 thousand tonnes in 2014-15.

Among the fibre crops, Jute is the most important but the area under jute cultivation is very low with only 0.122 thousand hectares. The production figure recorded in 2014-15 is 1.24 thousand tonnes and productivity is 10.2 tonnes/ hectares.

Besides these crops, other crops cultivated in the district are maize, pulses, potato, areca nut, banana, gram, tur, linseed, castor, sesame, cotton, Mesta, tobacco, chillies, sweet potato, small millet, papaya, tapioca, turmeric, onion, coconut etc.

2.6 FARM EFFICIENCY

As the expression of the farm efficiency implies, the ratio between the works or energy goes out of it and the work or energy put into it. The more energy we get out as yield per unit amount we put in, the more efficient the system is. Here, it is considered different crops on land or area is the input energy and productivity or yield is the output energy. The Relative Yield Index has been used to calculate the efficiency of farm in Jorhat district as an areal unit to the total yield of the state

Assam. The following table shows the relative yield (RY) of first three dominating crops i.e., rice, mustard and sugarcane.

Table 2.10

RELATIVE YIELD OF DIFFERENT CROPS

Sl.No.	Crops	Area In hectare	Production In tonne	Yield Tonne/hectare	*Yield In Assam*	Relative Yield (RY)
01.	Rice	347.47	569.90	1.62	1.74	93.1
02.	Mustard	67.42	32.36	0.48	0.53	90.6
03.	Sugarcane	07.37	255.74	34.7	39.1	88.7

Source: Field Survey, 2015-16.

Yield, data has been taken from Statistical Hand Book of Assam, 2015.

From the above table, it is clear that the farms under rice cultivation are efficient in terms of relative yield index. According to relative yield index, the suitability of a particular crop grown in a region may be ascertained by the percentage of relative yield. If the relative yield of a crop in a particular region is 90 per cent or above, the farm is efficient for that particular crop.

The area under rice cultivation of Jorhat district is 347.47 hectares, production 569.90 tonnes and yield is 1.65 tonnes/ hectare during the field survey of 200 peasant families. The relative yield of rice crop is 93.1 per cent which ascertained the efficient farm for rice cultivation of the region within the state. (Appendix I)

The second largest crop cultivation in Jorhat district is mustard. The area under this crop is 67.42 hectare, production 32.36 tonnes and yield is only 0.48 tonnes/ hectare. The relative yield of mustard is 90.6 per cent indicating the efficiency of the farm of that particular crop in respect of Assam.

The third dominating crop of Jorhat district is sugarcane. The area of sugarcane is 07.37 hectares, production 255.74 tonnes and yield is 34.7 tonnes/ hectare. The relative yield of sugarcane is 88.7 per cent which is inefficient farm crop. This may be due to negligible area of cultivation under this crop. Though the area

under sugarcane is very little compared with other two dominating crops, the productivity per hectare is satisfactory. If Sugarcane is considered to cultivate under a considerable tract of land then definitely this farm crop of this region will be efficient to the state.

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CHAPTER III

LAND HOLDING PATTERN

3.1 INTRODUCTION

Land is the basic, fixed and limited natural resource. Land plays the key role in the determination of man's economic activities as well as social and cultural progress. All agricultural, animal and forestry productions depend on the quality and productivity of the land. The entire terrestrial eco-system which comprises of soil, water and plant are survived on the land resource. It meets the demand of food, energy and other needs of livelihood. Singh, Jasbir (1997) has classified the five most natural land resources entities, namely the terrain, climate, soils, water resources and forest cover. Climate, relief and geological formations of the land are very stable resources. Soils and water are moderately stable resources while the vegetation and related biological features are relatively unstable resources. It shows that all the natural resources are associated to the holdings of land. The growing pressure of population and the increasing variety of demands being completed on land use. Therefore, it is necessary to know the existing land holding pattern at micro level in order to plan the optimum use of land.

Agriculture Census forms is a part of a broader system of collection of Agricultural statistics. It is a large scale statistical operation for the collection and derivation of quantitative information about the structure of agriculture in the country. An agricultural operational holding is the ultimate unit for taking decision for development of Agriculture at micro level. It is for this reason that an operational holding is taken as the statistical unit of data collection for describing the structure of agriculture. Through Agricultural Census it is endeavoured to collect basic data on important aspects of agricultural economy for all the operational holdings in the country.

The landholding structure of any agrarian country is generally complex and dynamic and its degree of dynamism primarily depends on the country's socio-economic, cultural and political systems.

In the light of new strategy adopted by the Government of India during 1966-67 for agricultural development, the individual operational holdings assume special significance in India as units of decision-making. It became more important on account of changed socio-economic conditions, the conduct of agricultural census centred on the operational holdings in India.

Use of modern techniques and agricultural requisites is not enough to ensure success of an agricultural development plan. Simultaneously, attention has to be paid to other problems which at the moment act as impediments to the rapid development of agriculture. Among these the important ones are economic, cultural and social factors. The primary cultural factors which contribute to the development of agriculture in an oriental agrarian society are: (i) land ownership (ii) fragmentation and land tenure problems (iii) limitation imposed by size of an operational holding,[29]

Ownership of land and the land tenure system adjust themselves to the environment but are related more directly to the socio-judicial organization of the rural population. The social system has a bearing on holding and field systems and on the settlement pattern with its related problems of accessibility to fields. The influence of the law of inheritance in governing the size of an individual holding is even more powerful and is the root cause of one of the greatest impediments to agricultural development. It fragments land into sub-marginal and marginal holdings which are economically not viable.

3.2 LAND OWNERSHIP

Individual ownership replaces land ownership or community ownership when agricultural land becomes scarce under the increasing burden of farm households on arable land. Individual ownership in India is associated with the breakdown of the joint family system, sedentary cultivation and the overspill of people from densely populated to the sparsely populated potential agricultural lands. Since agriculture is the mainstay of farmers, it is but natural that they should believe that one who owns land owns wealth. The systems of land ownership vary depending on various factors, such as a basic distinction between the old alluvial settlements and rain fed farming areas on the one hand and the reclamation of wasteland in new canal colonies on the other.

[29] Singh J. & Dhillon S.S., (2002), *Agricultural Geography*, p. 138

In the latter, landlord ownership is prevalent. However, the peasant-proprietorship predominates.

These systems of ownership have built in superior and inferior proprietorship. Certain classes, however, enjoy superiority over the large body of the cultivators who till the land. The majority of cultivators of land are the inferior proprietors in the agricultural set up. Others, such as tenants and lessees, have a transferable right to cultivation subject to a fixed rent in kind or cash, but the ownership of land is vested in superior proprietors, that is landlords.[30]

The occupancy tenants have been declared owners with a right of proprietorship on surplus areas of landlords after paying value for the land fixed by legislation. Hence, the number of inferior proprietors has increased. It is one of the major means of increasing production, as the cultivator himself reaps the whole crop. The new dispensation has changed tenant-cultivators into owner-cultivators.

The landlords and absentee owners, by tradition and habit, are not disposed to make any contribution to agricultural development as they lack the qualities or the mental make-up of a farm entrepreneur. In fact, land is best used by peasant-proprietors. Although their holdings are much smaller than those of the landlords, their gross income per unit area from cultivation and investment on inputs per unit area are significantly greater than those of the landlords and the absentee owners because of the latter's disinterest and casual attitude.

3.3 LAND TENURE SYSTEM

There are no reliable written records on land tenure system in Jorhat as well as Assam before the Ahoms came into the region and ruled it. The Ahoms ruled Assam for about six hundred years from the early 13th century and very lately they started introducing certain definite land tenure system.[31] For the first time Paik system of revenue administration was introduced during the reign of King Pratap Singha in 1607 A.D.[32] Accordingly each Paik was allotted two puras (1.02 hectare) of rupit land (paddy land) and land for housing and gardening called bari.

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[30] Op. Cit.
[31] Gait, E. (1984), *A History of Assam,* L.B.S. Publication, Guwahati.
[32] Mali, D.D. (1984), *Revenue Administration in Assam*. Omson Publication, Guwahati.

Instead of salaries, the officers appointed by the king were provided with the services of the Paiks. The Paik had to cultivate the land allotted to the officers for required grains. Moreover, the officers were given rent free land. The king also granted land for religious and charitable purposes to institutions as well as individuals and these were treated as private properties.

Assam was brought under the domain of British Empire in 1826, and the British gradually began to frame certain land regulations. An agency for collection of land revenue was brought into force in 1833, and each district was divided into some mousas and numbers of commission agent called mouzadars were appointed for collection of tax from all the residents of the mouzas.[33]

The Assam Land Revenue Regulation 1886, for the first time defined the rights to be attached with the owners of different classes of estates or interest in land. The main classes of estates or interest in land may be grouped as follows : (i) Lakhiraj ('la' means free and 'khiraj' means revenue) estates; (ii) Free-Simple estates; (iii) Permanently settled estates; (iv) Acknowledge estate; (v) Temporarily settle khiraj estates held direct from the government under periodic lease and (vi) Temporarily settled khiraj estates held direct from government on annual lease.[34]

The Assam Land Revenue Regulation, 1886 is the general revenue law of Assam and it is still in force. However, depending upon the rights and privileges enjoyed by the landholders, the land tenure system prevalent in the Jorhat district of Assam may be distinguished into two types : Zamindari and Ryotwari systems. In the zamindari system, revenue was collected by the zamindars who acquired the status of landlord. But under the Ryotwari system, the occupiers of relatively small independent holdings paid revenue directly to the Government. The other districts of Assam also have been following the same land tenure system, except the tribal dominated hills districts of Assam viz. Karbi-Anglong and North Cachar Hills have neither been cadastral surveyed, nor put under a system of land revenue assessment except for some parts of it which were formerly parts of Nagaon and Sibsagar districts at the time of its formation in 1951.[35]

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[33] Bhagabati, A.K. (1990), "Spatial Analysis of Small Scale Agriculture in Assam". G.U., Guwahati.
[34] Op. Cit.
[35] Das, M.M. (1984), *Peasant Agriculture in Assam*. Inter-India Publication, New Delhi.

3.4 LAND REFORM MEASURES

After independence, a number of land reform measures have been adopted by the state government in order to remove the defects in the existing land tenure system. The main objectives of such reformative measures were abolition of intermediaries, redistribution of land for optimum allocation of resources, protection of tenants from eviction, restriction of sub-letting, etc.[36] The following are the important measures under taken at different times for achieving these objectives.

3.4.1. The Assam State Acquisition of Zamindari Act, 1951.

A bill for abolishing the zamindari system prevalent in certain parts of Assam was passed in the State Assembly in March 1948 and it became an act in 1951, called the Assam State Acquisition of Zamindari System Act, 1951. This act aimed to establish direct relationship between the tenants and government abolishing the right of the zamindars. Already the rights of all proprietors in respect of 3,638 estates and tenure holders in respect of 4,333 number thereof covering an area of 6.7 lakh hectares have been acquired and as a result the rayats (tenants) of the erstwhile zamindars came to hold their land directly under the government.[37]

3.4.2. The Assam Fixation of Ceiling on Landholding Act, 1965.

With the aim reducing the glaring inequalities in the ownership of land and to satisfy the desire of the land less to possess land, this Act fixed 150 bighas (20 hectare) as the maximum limit of the holding. Since 1965, the Act has been amended several times. The last amendment, reducing the ceiling limit to 50 bighas (6.66 hectares) was made in 1975.[38]

3.4.3. The Assam Consolidation of Holding Act, 1960.

This Act seeks to consolidate the fragmented holdings and to prevent further fragmentation for better cultivation in the plain districts. A scheme for the work of consolidation was taken up in Rani area of Kamrup district on an empirical basis. But owing to various constraints the Act is yet to see its full implementation.[39]

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[36] Bhagabati, A.K., Op. Cit.
[37] The Assam Gazette, (1975).
[38] Ibid.
[39] Ibid.

3.4.4. The Assam (Temporarily Settled Areas) Tenancy Act, 1971.

In order to regulate the relations between the land lords and tenants in the temporarily settled areas of Assam, the Assam (Temporarily Settled Areas) Tenancy Act, 1971 was enacted. This Act recognises two types of tenants, viz., occupancy and non-occupancy tenants. It reduced the length of the time for acquiring the right of occupancy to 3 years instead of 12 years under ceiling regulations. According to the Act, the occupancy tenant can acquire the right of ownership over land by depositing an amount of 50 times more than the annual land revenue payable. Under the provision of the Act, the government launched a programme for updating the records of right of the tenants. Initially 3.03 lakhs persons were recorded as tenants, the figure came down to 2.78 lakhs in 1986 due to the settlement of tenanted land to the tenants themselves.[40]

3.4.5. The Assam Bhoodan Act, 1965.

Whereas it is expedient to facilitate the donation of land received as bhoodan in response to Bhoodan Jajna movement initiated by Acharya Vinoba Bhave and to provide for regularisation, distribution and settlement of such lands to the landless persons and it provide for matter ancillary. Under this Act, of the total of 4,774 hectares of land donated by the people, 341 hectares have been distributed among a section of land less cultivators of the state.[41]

All the policies of land reform discussed above influenced the land holding structure of the district as well as the state of Assam to arrive at the present study.

3.5. SIZE OF OPERATIONAL HOLDING

An operational holding in agriculture is defined as the all land which is used wholly or partially for agricultural production and is operated as one technical unit by one person alone or with others, without regard to title, legal form, size or location. A technical unit has been defined as that unit which is under the same management and has the same means of production such as labour force, machinery, animals etc.

An operational holder is the person who has the responsibility for the operation of the agricultural holding and who exercise the technical initiative and is responsible for its operation. He may have full economic responsibility or may share it with others.

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[40] The Assam Gazette, 1990.
[41] Ibid.

The operational holder may be individual, joint or institutional. If the holding is being operated either by one person alone or by group of person who are the members of the same household is considered as an individual holding. When two or more persons belonging to different households jointly share as partners in the economic and technical responsibility for the operation of an agricultural holding, such holding would be considered as joint holding. Holdings such as government farms, sugarcane factories and cooperative farms lands managed by trust would be treated as institutional holdings. A holding is said to be complete holding if the entire, operated area of that holding is located in one village. If the operated area is spread over more than one village, it would be considered as part holding. Tahsil would be taken as the outer limit for consolidation of part holdings.[42]

Jorhat district, which is at presently comprised of eight development blocks makes the region of high agricultural potentiality. According to 2011 census there is 2.08 lakhs of operational holdings occupying 2.15 lakhs hectares of land area in the study region. The percentage variation of holdings in the district over the last ten years is increasing enormously. The average size of farm in the district is 1.03 hectares which is slightly higher than the state's average of 1.02 hectares. Out of the total, more than 61 per cent belongs to the marginal farm size (below 1 hectare) group. But area wise this size class group covered only 15 per cent of the total operated area. Notable point is that, though large size class group (above 10 hectares) which constitutes only 0.27 per cent to the total holdings, covered as high as 25.88 per cent of the total operated area with an average farm size of 100.02 hectares. Moreover, there are more than 355 tea garden including out gardens and small tea gardens in Jorhat district which are included in operational area. Therefore, the actual average size of holding in peasant agricultural sector may be much smaller than what is stated above. The landholding pattern of Jorhat district is highly concentrated as more than 86 per cent of the total holdings cover only 35 per cent of the total operated area.

[42] "Agricultural Statistics at a Glance", 2005, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India.

Table: 3.1

NUMBER AND AREA OF OPERATIONAL HOLDING

JORHAT DISTRICT, 2011.

Size Class (in hectare)	No. Of Holdings	Percentage	Area	Percentage	Average
Below-1	127,917	61.38	31,853	14.77	0.25
1-2	52,638	25.26	44,637	20.69	0.85
2-4	22,547	10.82	50,792	23.55	2.25
4-10	4,728	2.27	32,565	15.11	6.88
Above 10	558	0.27	55,814	25.88	100.02
Total	208388	100.00	215661	100.00	1.03

Source: Office of the district Economics & Statistics, Jorhat.

DISTRIBUTIONS OF NUMBER AND AREA OF OPERATIONAL HOLDINGS

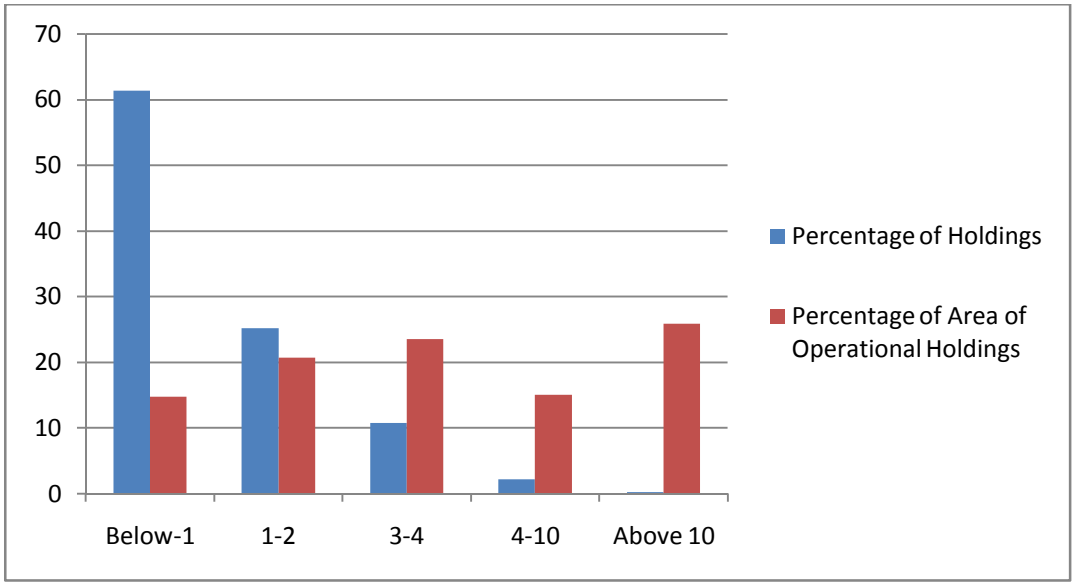

FIG 3.1

It is interesting to note from the table 3.1, that the medium size class (4-10 hectares) and large size class (above 10), indicate the decrease in number of holdings with increases in the size of the area. The medium size holdings are 4.7 thousands against the areas of 32.56 thousand hectares and the large size holdings are 0.5 thousand hectares where the areas are above 55.81 thousand hectares. Such type of

changes ultimately affected the small size categories (1-2 hectares) where both number of holdings have slightly increased over the period.

It is evident from table 3.2, that nearly 61 per cent of the holdings in Jorhat district are marginal holdings. More than 25 per cent of the district's total holdings are small holdings (1-2 hectares) which covers nearly 21 per cent of the total operated area of the district. Semi- medium holdings (2-4 hectares) which is 11 per cent of the total holdings, occupies nearly 24 per cent of the total operated area. Medium size holdings (4-10 hectares) cover about 2 per cent of the total holdings with an area of 15 per cent. On the other hand, large size category of holdings (above 10 hectares) shared only 0.27 per cent of the total holdings but comparatively with a large amount of land which is about 26 per cent of the total operated area of the district.

Table: 3.2

PERCENTAGE DISTRIBUTION OF NUMBER AND AREA OF OPERATED HOLDINGS OF JORHAT DISTRICT, (According to 2011 census).

Size Class (in hectare)	P.C. of holdings	Cf.	P.C. of Area	Cf.
Below-1	61.38	61.38	14.77	14.77
1-2	25.26	86.64	20.69	35.46
2-4	10.82	97.46	23.55	59.01
4-10	2.27	99.73	15.11	74.12
Above 10	0.27	100.00	25.88	100.00

Source: Office of the district Economics & Statistics, Jorhat.

From the above table 3.2, it is revealed that more than 86 per cent of the total landholding of Jorhat district is below 2 hectares, which is underestimation of the most important consideration of economic viability or non-viability of farm size. It has been pointed out that from the economic point of view 2 hectares size of holding is floor level.[43] Such a small size of holding suffers from various problems like size-disability, tenurail uncertainty and available human and animal labour.

[43] Khrusro, A. M. (1968), *Readings in Indian Agricultural Development*. Allied Publishers, New Delhi.

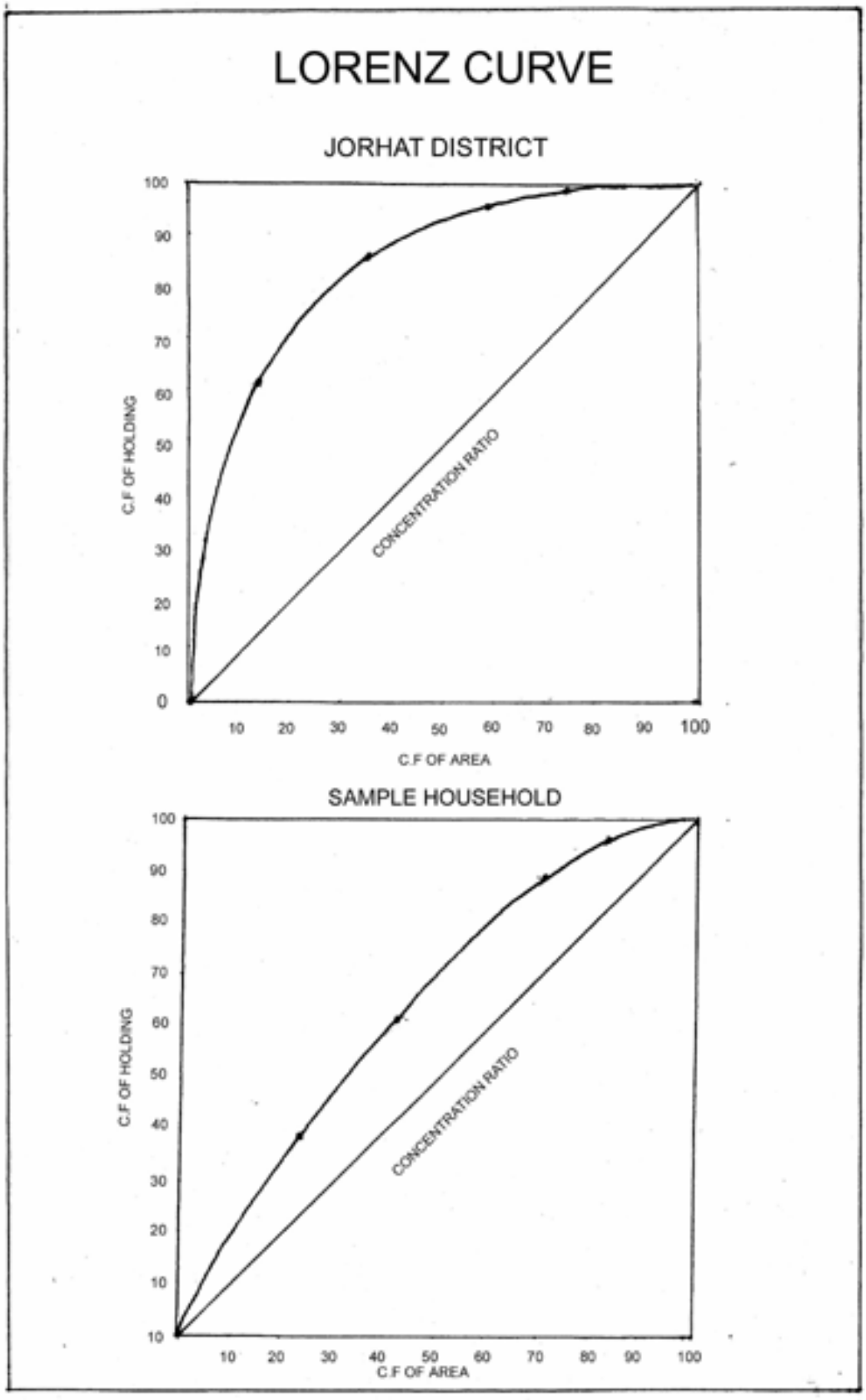
LORENZ CURVE
JORHAT DISTRICT
C.F OF HOLDING
CONCENTRATION RATIO
C.F OF AREA
SAMPLE HOUSEHOLD
C.F OF HOLDING
CONCENTRATION RATIO
C.F OF AREA

FIG 3.2

Another notable feature is that the holding pattern of the district is not equally distributed. More than 61 per cent of the total holdings covered only 14.77 per cent of the total operated area. These disparities remained more or less unaltered over the last 10 years.

The land holding pattern of Jorhat district is discussed broadly in chapter v on the basis of field survey of peasant families. It tries to show the distribution of landholding pattern of the district through Lorenz Curves with the help of both primary and secondary data. These curves show highly concentrated nature of landholding pattern. From the above situation it may be concluded that by and large, landholding system in Jorhat is dominated by small size holdings. The number of large farms or large holdings is comparatively less.

Table 3.3

CATEGORY WISE NUMBER OF WORKERS AND AREA OF OPERATIONAL HOLDINGS OF JORHAT DISTRICT,

(As per 2011 census)

Category of Workers (main & marginal)	Number	P.C.	Area (In hectare)	P.C.	Average
Cultivator	145,885	29.26	118,656.68	55.02	0.81
Agricultural labour	53,153	10.66	48,890.35	22.67	0.92
Workers in household Industry	31,543	6.33	17,209.75	7.98	0.54
Other Workers	268,037	53.75	30,904.22	14.33	0.12
Total	498,618	100.00	215,661	100.00	0.43

Source: District Census Handbook, Jorhat, 2011.

CATEGORY WISE NUMBER OF WORKERS AND AREA OF OPERATIONAL HOLDINGS

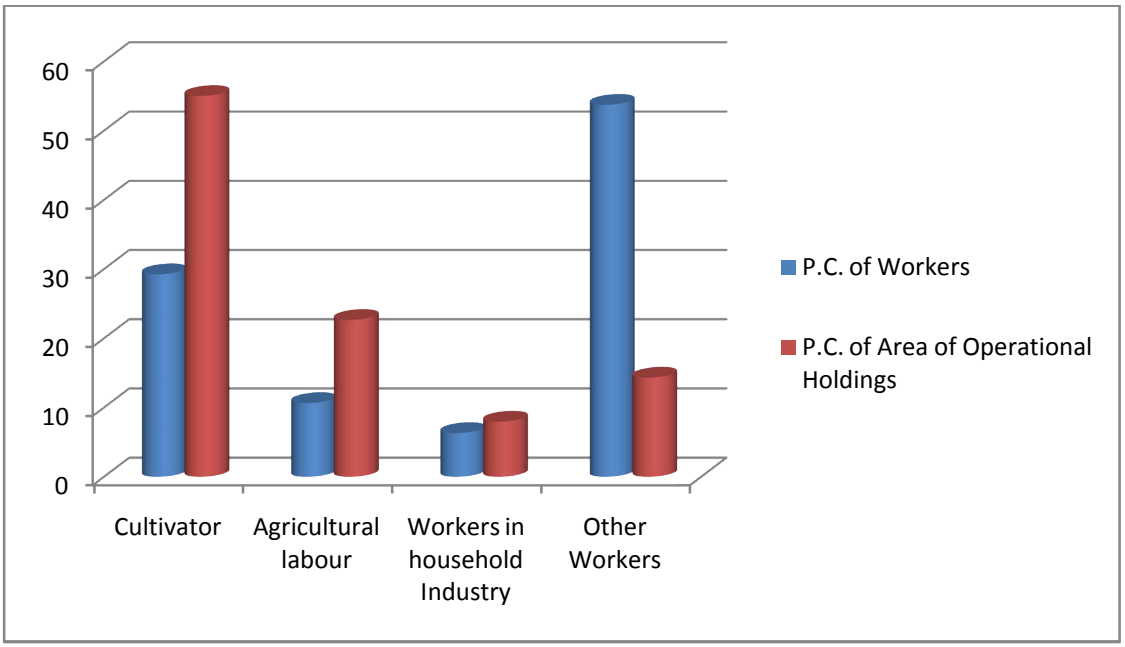

FIG 3.3

The landholding patterns of Jorhat district in terms of number of workers are very significant. According to 2011 census, the total numbers of workers were 4.9 lakhs occupying 2.2 lakhs hectares of land of the study region. The average size of holding of the district is 0.43 hectares which is slightly lower than the state's average of 0.47 hectares. The number of cultivators of Jorhat district is 1.4 lakhs occupying an area of 1.2 lakh hectares where the average landholding is 0.81 hectares. There are 53.2 thousand agricultural labours occupying 48.9 thousand hectares of land area in the district where the average holding is 0.92 hectares. It is interesting to note that the number of cultivators is more than the agricultural labours but holding per hectare is less than the agricultural labours. It may be due to the involvement of family labours in agricultural sector. The workers in household industry are quite less in numbers i.e. 31.5 thousand, occupying 17.2 thousand hectares of land area in the district with average holding per hectare of 0.54. The workers of the last category are maximum in numbers 2.7 lakhs occupying 30.9 thousand hectares of land area and the average holding is only 0.12 hectares.

It may be mentioned that the average land holding of the last two categories of workers in the district are comparatively less than the first two categories i.e., 0.54 and

0.12 hectares respectively. The maximum numbers of these last two categories live in urban areas and they involve in business, industry and other domesticated works.

It is evident from the table 3.3 that more than 53 per cent workers of the district are belonged to the other workers category. But they cover only 14 per cent of the total operated area of the district. It can be mentioned that nearly 40 per cent of the district's total workers are engaged in agricultural sector i.e. cultivator and agricultural labour.

Another notable feature is that the maximum size of operational holding of the district in terms of workers is 77 per cent in agricultural sector. The percentage of last two categories of size of operational holding is negligible.

3.6. CASTEWISE DISTRIBUTION OF LAND HOLDING

Landholding distribution of Jorhat district is dominated among the tribals, schedule castes and other castes holders as a whole. Number of Schedule Castes holders in the district is very less, which is only 8 per cent to the total number of holders. The area occupied by Scheduled Castes holder is also extremely less which is only 6.96 per cent to the total operated area of the district. Scheduled Tribes farmers constitute nearly 13 per cent numbers of holdings occupying 14 per cent of the total operated area of the study region. More than 79 per cent farmers of the district are non- tribals with almost an equal proportion of operated area.

All the development blocks of Jorhat district are marked by high percentage of landholdings, other than Schedule Caste and Schedule Tribe group. Baghchung, Kamalabari and Dhekorgorha have comparatively high number of Schedule Caste holdings accordingly 13 thousand, 19 thousand and 20 thousand in numbers. The operated areas of these three blocks are 2.9 thousand hectares, 3.1 thousand hectares and 4.3 thousand hectares respectively. Titabor is occupying the fourth position in terms of number of Schedule Caste holdings i.e., 9 thousand.

From the table 3.4, it can be mentioned that Ujoni Majuli has occupied the first position in term of number of holdings of Schedule Tribe category. This alone is occupying to 40.5 thousand holdings with 11.1 thousand hectares of operated area. Kamalabari has 37 thousand holdings with 10.1 thousand hectares of operated area. Similarly Dhekorgorha, Titabor and Baghchung have 19.8 thousand, 18.8 thousand and 10.5 thousand numbers of holdings with 3.1 thousand hectares, 2.2 thousand

hectares and 1.9 thousand hectares of operated area respectively under Schedule Tribe group. Another three blocks have less number of holdings as well as operated area under ST group.

Table: 3.4

CASTE WISE DISTRIBUTION OF NUMBER AND AREA OF OPERATIONAL HOLDINGS IN EIGHT DEVELOPMENT BLOCKS OF JORHAT DISTRICT, ASSAM.

Development Blocks	Scheduled Castes		Scheduled Tribes		Others	
	Number	Area	Number	Area	Number	Area
Titabor	9,107	1,654	18,806	2,267	126,239	24,917
Selenghut	1,908	545	1,134	367	86,734	20,115
Kaliapani	6,026	812	7,867	1,534	62,065	19,262
Chipahikhola	3,176	787	1,303	352	89,583	19,841
Baghchung	13,903	2,952	10,517	1,958	232,391	31,985
Dhekorgorha	20,845	4,376	19,892	3,152	94,158	20,347
Ujoni Majuli	4,085	721	40,520	11,184	24,242	9,677
Kamalabari	19,793	3,163	37,083	10,176	41,581	23,517
Total	88,665	15,010	139,917	30,990	836,646	169,661

Source: District Census Handbook, Jorhat, 2011.

The whole land holding pattern of Jorhat district is dominated by non-tribal and non- Schedule Caste holders. It is clear from the above table that all the blocks of Jorhat district belonged to other category holders except the Ujoni Majuli development block which is dominated by Schedule Tribe holders. Baghchung block has the maximum number of non-tribal and non- Schedule Caste holdings i.e., 2.3 lakhs with 31.9 thousand hectares of operated area. Titabor has the second highest non-ST and non-SC holdings within the district, 1.2 lakhs of holdings which occupy 24.9 thousand hectares of operated area.

Table: 3.5

PERCENTAGE CASTE WISE DISTRIBUTION OF NUMBER AND OPERATIONAL HOLDINGS IN EIGHT DEVELOPMENT BLOCKS OF JORHAT DISTRICT, ASSAM.

Development Blocks	Schedule Caste		Schedule Tribe		Others	
	P.C. of Number	P.C. of Area	P.C. of Number	P.C. of Area	P.C. of Number	P.C. of Area
Titabor	0.83	0.76	1.72	1.05	11.56	11.55
Selenghut	0.17	0.25	0.10	0.17	7.94	9.33
Kaliapani	0.55	0.38	0.72	0.71	5.68	8.93
Chipahikhola	0.29	0.36	0.12	0.16	8.20	9.20
Baghchung	1.27	1.37	0.96	0.91	21.27	14.83
Dhekorgorha	1.91	2.03	1.82	1.46	8.62	9.43
Ujoni Majuli	0.37	0.33	3.70	5.18	2.22	11.24
Kamalabari	1.81	1.46	3.39	4.72	3.81	10.90
Total	8.12	6.96	12.81	14.37	79.07	78.67

Source: District Census Handbook, Jorhat, 2011.

It is evident from the table 3.5, that Baghchung block has highest percentage of landholding as well as percentage of operated area of non-SC and non-ST group among the other blocks of Jorhat district. It alone occupies 21.27 per cent of the total landholdings of the district against 14.83 per cent of area cover from the total area. On the other hand Ujoni Majuli development block has the highest percentage of Schedule Tribe group, not only the numbers of holdings but also the operated area. There are 3.70 per cent of the total landholdings of the district with 5.18 per cent of total area covered. Mainly Mising Community holders dominated in Ujoni Majuli development block. Similarly, Dhekorgorha development block is dominated by Schedule Caste group. It has the highest percentage of Schedule Caste population in terms of number

of holdings 1.91 per cent as well as operated area 2.03 per cent among the other blocks of the district.

3.7. BLOCK WISE DISTRIBUTION OF LANDHOLDING PATTERN

The landholding pattern of eight development blocks under Jorhat district is significant in quality. According to 2011 census, out of the total 2.36 lakh holdings of Jorhat district 2.08 lakh holdings is considered in total holdings and from the total 2.85 lakh sq. Km. of area, only 2.15 lakh sq. Km. is considered to total operated area. The plain area has been occupying with 75.64 per cent of district's total area possessing 88.20 per cent of the total number of holdings. The block level, variation is found in the Jorhat district in terms of both number of holdings and operated area. In some blocks, the proportion of operated area were found to be lesser than their respective proportion of number of holdings and some other blocks this cases is inverse. But the district of Jorhat with relatively low population density have more proportions of area operated than the proportion of number of holdings in relation to the state's total.

The relatively large number of holding in Baghchung development block, Titabor development block and Dhekorgorha development block of Jorhat district are mainly due to existence of the huge number of holdings of tea garden. On the other hand, out of the eight development blocks, Baghchung development block is industrially developed,. so numbers of holdings are increasing day by day.

Similarly, the high size of operated area under Kamalabari development block, Titabor development block and Baghchung development block is due to the introduction of plantation agriculture and the gradual change of agricultural practices from subsistence agriculture to sedentary.

Table 3.6, highlights that out of the total 2.08 lakh holdings of the district, the Titabor development block with 16.64 per cent of the district's total area possess 15.83 per cent of the total number of holdings. There is 9.75 per cent of the district's total area possessing 9.56 per cent to the total number of holdings in Selenghut development block. Kaliapani development block has occupied 10 per cent of the district's total area with 7.96 per cent of the total number of holdings. It is observed that there are 9.92 per cent to the total number of landholdings in Chipahikhola development block with 9.73 per cent of the district's total area of land cover.

Table 3.6

BLOCK WISE NUMBER AND AREA OF OPERATIONAL HOLDINGS IN JORHAT DISTRICT,

(Area in hectare)

Name of the block	No. of the holdings	Percentage	Operated Area	Percentage
Titabor	32,983	15.83	35,906.91	16.64
Selenghut	19,924	9.56	21,026.84	9.75
Kaliapani	16,594	7.96	21,606.44	10.02
Chipahikhola	20,669	9.92	20,980.36	9.73
Baghchung	57,614	27.64	29,827.92	13.83
Dhekorgorha	28,368	13.62	27,875.13	12.94
Ujoni Majuli	12,962	6.22	21,581.11	10.01
Kamalabari	19,274	9.25	36,856.76	17.08

Source: District Census Handbook, Jorhat, 2011.

BLOCK WISE NUMBER AND AREA OF OPERATIONAL HOLDINGS

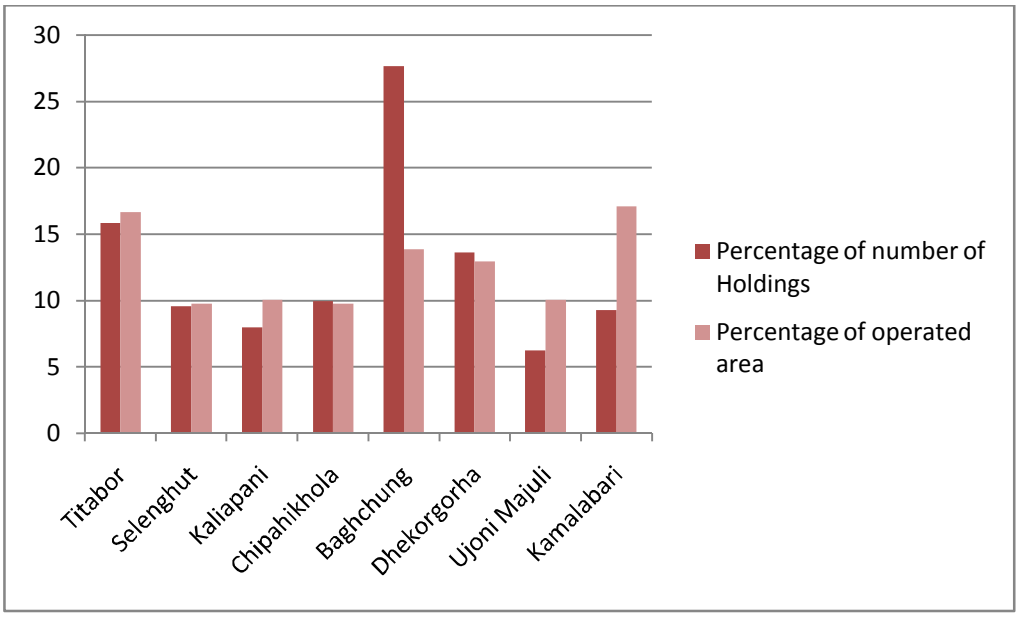

FIG 3.4

The block of Baghchung with 13.83 per cent of the total operated area in the district accounts for highest i.e. 27.64 per cent of the total number of holdings. This is due to the existence of large number of plantation estates and industrial colony within the district.

The Dhekorgorha development block with 12.94 per cent of the district's total area possesses 13.62 per cent of the total number of holdings. On the other hand, Ujoni Majuli development block with 6.22 per cent of the total number of holdings and 10.01 per cent of the total operated area of the district. The development block of Kamalabari with 9.25 per cent of the total holdings in the district account for highest i. e., 17.08 per cent of the total operated area.

Table: 3.7

BLOCK WISE AVERAGE FARM SIZE OF JORHAT DISTRICT,

(Area in hectare)

Blocks	No. Of Holding	Area	Average Farm Size
Titabor	32,983	35,906.91	1.09
Selenghut	19,924	21,026.84	1.06
Kaliapani	16,594	21,606.44	1.31
Chipahikhola	20,669	20,980.36	1.02
Baghchung	57,614	29,827.92	0.52
Dhekorgorha	28,368	27,875.13	0.98
Ujoni Majuli	12,962	21,581.11	1.66
Kamalabari	19,274	36,856.76	1.91
Total	208,388	215661.47	1.03

Source: District Census Handbook, Jorhat, 2011.

The average size of farm in the district is 1.03 hectare which is slightly higher than the state's average of 1.02 hectare in 2011. The average size of farm is lowest in the Baghchung development block which is only 0.52 hectare. On the other hand, the

highest average of farm size is found in the development block of Kamalabari with an average size of the farm 1.91 hectare. Other development blocks of Jorhat district is followed by Titabor development block with 1.09 hectare, Selenghut development block with 1.06 hectare, Kaliapani development block 1.31 hectare, Chipahikhola development block 1.02 hectare, Dhekorgorha development block 0.98 hectare, and Ujoni Majuli development block 1.66 hectare respectively.

For fulfilment of a research work, it was necessary to collect the block wise different primary data including number of holdings and operated area of the study region. As mentioned in the sample design (chapter I), in the field investigation equal sample based on random sampling has been taken from each and every block of Jorhat district which are taken as number of holdings for the study. On the basis of the village survey, a total of 200 sample peasants' families in eight different blocks of Jorhat district can be mentioned.

Table 3.8

BLOCK WISE NUMBER AND AREA OF OPERATIONAL HOLDINGS IN EIGHT DEVELOPMENT BLOCKS OF JORHAT DISTRICT.

(Area in hectare)

Name of the Blocks	No. Of the Holdings	P.C.	Operated Area	P.C.
Titabor	25	12.5	86.99	18.62
Selenghut	25	12.5	48.55	10.39
Kaliapani	25	12.5	50.78	10.87
Chipahikhola	25	12.5	34.67	7.42
Baghchung	25	12.5	45.59	9.76
Dhekorgorha	25	12.5	53.40	11.43
Ujoni Majuli	25	12.5	68.64	14.69
Kamalabari	25	12.5	78.58	16.82
Total	200	100	467.2	100

Source: Field Survey.

It is clear from the above table that the total number of operated area of sample household is 467.2 hectares, out of which the highest size of operated area is occupied by Titabor development blocks with 18.62 per cent. On the other hand, Chipahikhola development blocks of Jorhat district possesses lowest size of operated area with 7.42 per cent to the total area of the sample survey. The reason may be the strategic location of the block which is situated at the heart of Jorhat City as well as the district, where maximum numbers of people are engaged in secondary and tertiary activity. Other blocks are followed by 10.39 per cent in Selenghut development block, 10.87 per cent in Kaliapani development block, 9.76 per cent in Baghchung development block, 11.43 per cent in Dhekorgorha development block, 14.69 per cent in Ujoni Majuli development block, and 16.82 per cent in Kamalabari development block.

Table: 3.9

BLOCK WISE AVERAGE FARM SIZE

IN EIGHT DEVELOPMENT BLOCKS OF JORHAT DISTRICT

(Area in hectare)

Name of the Blocks	No. Of Holdings	Area	Average Farm Size
Titabor	25	86.99	3.5
Selenghut	25	48.55	1.9
Kaliapani	25	50.78	2.0
Chipahikhola	25	34.67	1.4
Baghchung	25	45.59	1.8
Dhekorgorha	25	53.40	2.1
Ujoni Majuli	25	68.64	2.7
Kamalabari	25	78.58	3.1
Total	200	467.2	2.3

Source: Field Survey.

It is evident from the above table that the average size of the farm of sample survey is 2.3 hectares to the total 4.6 hundred hectares of area under 200 holdings. Out of the total of eight development blocks of Jorhat district, the highest average size of farm is 3.5 hectares and the lowest average size of farm is 1.4 hectare. But if we categorised the number of holdings and operated area in different size group of farms, then average size of farm will change.

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CHAPTER IV

AGRICULTURE PRODUCTION

4.1 INTRODUCTION

Agriculture is the cultivation of animals, plants and fungi for food, fiber, bio fuel medicinal plants and other products used to sustain and enhance human life.[44] Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that natured the development of civilization. The study of agriculture is known as agricultural science. The history of agriculture dates back thousands of years, and its development has been driven and defined by greatly different climates cultures and technologies. Industrial agriculture based on large scale monoculture has become the dominant agricultural methodology. On the other hand, agriculture food production and water management are increasingly becoming global issues that are fostering debate on a number of fronts. Significant degradation of land and water resources, including the depletion of aquifer has been observed in recent decades and the effects of global warming on agriculture and of agriculture on global warming is vast topic of research.

The major agricultural products can be broadly grouped into foods, fuels and raw materials. Specific foods include cereals, vegetable, fruits, oils, meats and spices. Fibres include cotton, wool, hemp, silk and flax. Raw materials include lumber and bamboo. Other useful materials are also produced by plants, such as resins, dyes, drugs, perfumes, bio-fuels and ornamental products such as cut flowers and nursery plants. Over one third of the world's workers are employed in agriculture, second only to the service sector.

Agriculture is one of the main components for the sustainability of human civilization. However, through today's advanced technology; the production of agriculture is slowly shifting its focus to create goods that are safe for society and the environment. Those interested in using science to positively impact society and the environment may consider systematic study of agricultural production. Agriculture

[44] International Labour Organization, (1999), "Safety and Health in Agriculture". p.-77, ISBN- 978-92-2-111517-5.

production analysis should critically identify and resolve environmental issues like crop production and farming. Other topics include soil science, plant growth, pest control, poultry production and agricultural leadership.

The history of agriculture in India dates back to Indus valley civilization era and even before that in some parts of southern India.[45] Today, India ranks second worldwide in farm output. Agriculture and allied sectors like foresty and fisheries accounted for 13.7 per cent of the GDP (gross domestic product) in 2013, about 50 per cent of the workforce.[46] The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

India exported $ 39 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and the sixth largest net exporter.[47] Most of the agriculture exports serve developing and least developed nations. Indian agricultural / horticultural and processed foods are exported to more than 100 countries, primarily in the Middle-East, South-East Asia, SAARC countries, the EU and the United States.

The Agricultural development of Assam in general as well as the Jorhat district in particular is on subsistence level and land is by and large below marginal. Though the Brahmaputra Valley is the fertile regions of the district, the average yield of crops is much lower. The district is not self-sufficient in food grains, though more than 70 per cent of the working population of the district is engaged in agriculture as their main source of livelihood. Every year the district has to import food grains from other parts of the state as well as country to meet its domestic needs.

[45] Https// books Google ca/books, *Agriculture in India*.
[46] Central Intelligence Agency Archived," CIA Fact book India", 11 June 2008.
[47] Staff India Brand Equity Foundation, "Agriculture and Food in India", 7 May 2013.

4.2 CROPS OUTPUT

Varieties of crops are grown in the Jorhat district in different seasons in varied land and climatic situation. Among these various crops, food grains are the most important crops which are cultivated in the entire district.

4.2.1. PADDY

It is the main crop of the district and it is cultivated in three different seasons of the year. Sowing, transplanting and harvesting time for these three seasons is given in the table 4.1. The production of total paddy in Jorhat district in 2014-15 was 27.10 lakh quintals. The average yield of paddy in the district was 29.38 quintals per hectare.

Table 4.1

SEASONS OF PADDY CULTIVATION IN JORHAT DISTRICT.

Sl. No.	Paddy Crop	Month of		
		Sowing	Transplanting	Harvesting
1.	Winter (Sali) Normal Late	 April-May June-August.	 June-July August- Sept.	 Oct.- Dec. Nov.- Jan.
2.	Autumn (Ahu) A. Direct seeded i. Early ii. Regular B. Transplanted i. Early ii. Regular	 Feb. – March Mar. – April February Mar- April	 - - Mar.- April April-May	 Early Jun-Jly. July- mid Sept. June-July July- August
3.	Summer (Boro) Regular	 Nov.- Dec.	 Dec.- Jan.	 April- May.

Source: Directorate of Agriculture, Assam, 2015.

Table 4.2

AREA, PRODUCTION AND AVERAGE YIELD OF FOOD GRAINS IN JORHAT DISTRICT DURING 2014-15

(Area in hectares, Production in quintals and Yield in quintals/hectares)

Sl. No.	Food Grains	Area in hectare	Production in quintals	Average Yield (qtl/hec.)
1.	Autumn Paddy	6,450.00	1,61,300.00	25.00
2.	Winter Paddy	83,100.00	24,92,900.00	30.00
3.	Summer Paddy	2,710.00	56,600.00	20.94
4.	Wheat	520.00	600.00	12.00
5.	Black gram	2,980.00	17,900.00	6.00
6.	Green gram	2,070.00	12,400.00	6.00
7.	Pea	1,050.00	6,200.00	5.94
8.	Lentil	520.00	2,700.00	5.20
9.	Mustard	9,390.00	80,000.00	8.50
10.	Sesame	220.00	1,100.00	5.20
11.	Potato	3,110.00	2,98,000.00	96.00
12.	Sugarcane	500.00	16,700.00	33.75
13.	Ridge gourd	270.00	5,000.00	18.20
14.	Pumpkin	610.00	30,200.00	50.00
15.	Kharif Vegetables	3,600.00	3,10,300.00	86.20
16.	Rabi Vegetables	6,500.00	4,29,900.00	66.16
17.	Garlic	890.00	53,400.00	60.00
18.	Ginger	150.00	7,800.00	52.00
19.	Areca nut	3,090.00	5,932.00	192.00
20.	Banana	3,400.00	5,19,400.00	153.00
21.	Assam Lemon	920.00	1,06,200.00	115.40

Source: Krishi Vigyan Kendra (KVK) Jorhat, 2015.

It is observed that the autumn paddy (ahu) and summer paddy (boro) had low productivity growth in the district. The productivity rate of winter paddy (Sali) is significantly high in the district and area under this crop is also very high with compared to the others two crops. This is primarily because of introducing high yielding varieties of seeds with sufficient rainfall during the sowing and transplanting months. It may be mentioned that the scope for bringing more area under this crop is very high in the district in view of the fact that most of the land under winter paddy could be practised double cropping.

Table 4.3

AREA, PRODUCTION AND PRODUCTIVITY OF THREE DIFFERENT TYPES OF PADDY

(Area in hectares, Production in quintals and productivity in qtl./hec.)

Sl.no.	Paddy	Area	Production	Productivity	% of growth
1	Autumn	6,450	1,61,300	25.00	2500
2.	Winter	83,100	24,92,900	30.00	2999
3.	Summer	2,710	56,600	20.94	2088
Total		92,260	27,10,800	29.38	2938

Source: Krishi Vigyan Kendra, Jorhat, 2014-15.

It is evident from the table 4.4 that the production of paddy in Jorhat district is 5.7 hundred tonnes in 2015-16. The average productivity of paddy in the district is 1.64 tonnes per hectares. Out of the eight development blocks of Jorhat district, the highest amount of paddy output is recorded in Titabor development block which is 1.45 hundred tonnes where the average yield is also maximum in 2.02 tonnes per hectare. The second position is Kamalabari development block with production of 1.17 hundred tonnes and the average yield is 1.84 tonnes per hectare in 2015-16.

Table 4.4

PRODUCTION OF PADDY IN EIGHT DEVELOPMENT BLOCKS OF JORHAT DISTRICT IN 2015-16.

(Area in hectare, Production in tonnes and Productivity in tonnes/ hectare)

Sl.no.	Name of the Blocks	Area	Production	Productivity
01.	Titabor	72.03	145.50	2.02
02.	Selenghut	33.59	44.02	1.31
03.	Kaliapani	35.82	50.86	1.42
04.	Chipahikhola	19.71	22.07	1.12
05.	Baghchung	30.63	42.02	1.37
06.	Dhekorgorha	38.44	55.74	1.45
07.	Ujoni Mazuli	53.68	92.46	1.82
08.	Kamalabari	63.57	117.23	1.84
Total		347.47	569.90	1.64

Source: Field Survey.

4.2.2. WHEAT

The production of wheat in Jorhat district is very negligible and the area under this crop is also comparatively smaller. Rice is the staple food of the people of this region and the consumption of wheat and other wheat preparation is low. The area under wheat in Jorhat district was only 5.2 hundred hectares and the total production was 600 quintals (60 tonnes) in 2014-15 where the average productivity of wheat was 12 quintals/hectares of the area. Block wise the scenario of wheat production are shown in the following table.

Table 4.5

PRODUCTION OF WHEAT IN EIGHT DEVELOPMENT BLOCKS OF JORHAT DISTRICT IN 2015-16.

(Area in hectare, Production in tonnes and Productivity in tonnes/ hectare)

Sl.no.	Name of the Blocks	Area	Production	Productivity
01.	Titabor	-	-	-
02.	Selenghut	-	-	-
03.	Kaliapani	-	-	-
04.	Chipahikhola	-	-	-
05.	Baghchung	-	-	-
06.	Dhekorgorha	0.47	0.395	0.840
07.	Ujoni Majuli	2.87	2.927	1.019
08.	Kamalabari	1.07	0.691	0.645
Total		4.41	4.013	0.909

Source: Field Survey.

It is clear from the table 4.5 that the wheat production of Jorhat district is negligible. Out of the eight development blocks, there are only three blocks having cultivated wheat crop as their domestic needs, whereas out of these three, only Ujoni Majuli development block can be counted. On the basis of field investigation, the area under wheat is only 4.41 hectares which is only 0.94 per cent to the total sample cropped area (467.2 hectares) of the district. The total production is 4.013 tonnes, where the productivity is 0.909 tonnes / hectare in entire district.

4.2.3. MAIZE

Besides Paddy and Wheat, Maize is another important food grain in Jorhat district. It occupies the second position after paddy in terms of area as well as production. It can be cultivated in almost all the blocks in the entire Jorhat district.

Table 4.6

PRODUCTION OF MAIZE IN JORHAT DISTRICT, 2015-16

(Area in hectare, Production in tonnes and Productivity in tonnes/hectare)

Sl.no.	Name of the Blocks	Area	Production	Productivity
01.	Titabor	2.07	2.695	1.320
02.	Selenghut	0.64	0.647	1.010
03.	Kaliapani	0.47	0.457	0.972
04.	Chipahikhola	0.17	0.160	0.941
05.	Baghchung	0.22	0.207	0.940
06.	Dhekorgorha	0.42	0.400	0.952
07.	Ujoni Majuli	1.84	2.024	1.100
08.	Kamalabari	2.03	2.842	1.400
Total		7.86	9.432	1.200

Source: Field Survey.

The area under maize cultivation is 7.86 hectares as per the field survey, 2015-16 which is 1.68 per cent to the total sample cropped area in the district. The total production of maize in the district is 9.4 tonnes, where the productivity is 1.2 tonnes /hectare. The highest production of maize is seen in Kamalabari development block which is 2.842 tonnes and productivity is 1.400 tonnes/ hectare.

4.2.4. MUSTARD SEED

Besides food grains, a large number of oil-seeds are grown in the district. Mustard is the principal oil-seed and it is also the second largest crop of the entire region in terms of area. (Table 4.7).

Table 4.7
AREA, PRODUCTION AND PRODUCTIVITY OF OIL SEEDS IN JORHAT DISTRICT, 2015-16.
(Area in hectare, Production in tonnes and Yield in tonnes/ hectare)

Sl.no.	Name of the Blocks		Lentil	Sesame	Mustard
01.	Titabor	A	2.070	1.150	6.010
		P	1.076	0.546	5.270
		Y	0.520	0.475	0.877
02.	Selenghut	A	0.420	0.070	0.050
		P	0.202	0.035	0.037
		Y	0.481	0.501	0.740
03.	Kaliapani	A	0.210	-	0.030
		P	0.109	-	0.019
		Y	0.522	-	0.666
04.	Chipahikhola	A	-	-	11.240
		P	-	-	10.140
		Y	-	-	0.902
05.	Baghchung	A	-	-	0.040
		P	-	-	0.029
		Y	-	-	0.725
06.	Dhekorgorha	A	0.170	0.360	3.450
		P	0.088	0.202	2.646
		Y	0.519	0.561	0.767
07.	Ujoni Majuli	A	7.640	3.640	10.270
		P	4.120	1.991	8.855
		Y	0.513	0.547	0.862
08.	Kamalabari	A	4.470	2.270	13.860
		P	2.179	1.224	11.211
		Y	0.517	0.539	0.808
Total		A	14.980	7.490	44.950
		P	7.774	3.963	38.207
		Y	0.519	0.529	0.850

Source: Field Survey.

The area under mustard cultivation is 44.95 hectares in 2015-16 which is 10 per cent to the total sample cropped area of the district. The total production of mustard in the region is 38.21 tonnes (38000 kg.) where the productivity is 850 kg per hectare of area. Block wise, Kamalabari development block having the highest amount of land under this crop is with a low yield of 808 kg. Land under mustard in Chipahikhola block is comparatively lower than Kamalabari block, but the yield rate is highest in this block with 902 kg. per hectare.

Besides mustard seed, sesame is cultivated in many parts of this district. According to the field investigation, the area under sesame cultivation is 7.49 hectares which is 1.60 per cent to the total cropped area. The production of sesame in the study area is 3.96 tonnes (3960 kg.) where the average yield is 529 kg. per hectare. It has been revealed during field study that there are no area under sesame cultivation in three blocks of Jorhat district like Kaliapani, Chipahikhola and Baghchung development blocks. On the other hand, in case of lentil cultivation, two blocks under Jorhat district are completely absent. The area under lentil cultivation is 14.98 hectares in 2015-16 which is almost 3.21 per cent to the total sample cropped area of the district. The production of sesame in the Jorhat district is 7.8 tonnes where the productivity is 519 kg. per hectare.

4.2.5. SUGAR CANE

Sugar cane is the most important fibre crop production in the district. Area under sugarcane in the study area is 2.67 hectares which is only 0.57 per cent to the total sample cropped area of the region. The total production of sugarcane in the district is 8.2 tonnes whereas the productivity is 3.067 tonnes (3067 kg.) per hectare.

Among the eight development blocks of Jorhat district, Dhekorgorha development block has recorded maximum amount of land under this crop and also the production is high. This is due to seems the continuity of sugarcane cultivation that a sugar mill was running in the nearest district Golaghat which encouraged people to produce more sugarcane in this block and the trend has been continuing at present.

Table 4.8

PRODUCTION OF SUGARCANE IN EIGHT DEVELOPMENT BLOCKS OF JORHAT DISTRICT, 2015-16.

(Area in hectare, Production in tonnes and Productivity in tonnes/hectare)

Sl. no.	Name of the Blocks	Area	Production	Productivity
01.	Titabor	0.34	1.022	3.037
02.	Selenghut	0.15	0.424	2.832
03.	Kaliapani	0.16	0.428	2.739
04.	Chipahikhola	0.12	0.322	2.687
05.	Baghchung	0.14	0.401	2.858
06.	Dhekorgorha	0.80	2.574	3.342
07.	Ujoni Majuli	0.47	1.453	3.112
08.	Kamalabari	0.49	1.564	3.214
Total		2.67	8.188	3.067

Source: Field Survey.

It is clear from the above table 4.8, that the productivity of sugar cane is overwhelming as compared to the others crops of Jorhat district. The growth rate of sugar cane is almost equal among the eight development blocks.

Besides these agricultural crops, a large number of horticultural crops and varieties of miscellaneous crops are grown in the entire study area. It has been attempted to show a clear scenario of some other major agricultural and horticultural crops that are grown in different development blocks of Jorhat district (Table 4.9).

Table 4.9

AREA, PRODUCTION AND PRODUCTIVITY OF MISCELLANEOUS CROPS IN JORHAT DISTRICT, 2015-16.

(Area in hectare, Production in tonnes, Productivity (Yield) in tonnes/hectare)

Sl.no.	Name of the Blocks		Potato	Banana	Areca nut
01.	Titabor	A	3.02	1.32	1.26
		P	31.311	19.965	25.389
		Y	10.370	15.140	20.150
02.	Selenghut	A	0.61	1.28	1.27
		P	5.929	19.059	26.712
		Y	9.72	14.890	21.100
03.	Kaliapani	A	0.57	1.31	1.26
		P	5.557	19.774	25.351
		Y	9.75	15.110	20.120
04.	Chipahikhola	A	0.48	1.27	1.25
		P	4.584	18.659	24.212
		Y	9.550	14.850	19.370
05.	Baghchung	A	0.51	1.28	1.25
		P	4.881	19.087	24.050
		Y	9.570	14.920	19.240
06.	Dhekorgorha	A	0.57	1.29	1.25
		P	5.739	19.260	24.463
		Y	10.07	14.950	19.570
07.	Ujoni Majuli	A	2.25	1.33	1.27
		P	20.663	20.126	26.127
		Y	9.180	15.30	21.360
08.	Kamalabari	A	2.10	1.32	1.28
		P	18.402	19.758	27.211
		Y	9.26	15.120	22.04
Total		A	10.11	10.40	10.09
		P	97.066	155.688	203.515
		Y	9.60	14.970	20.170

Source: Field Survey.

Table 4.10

AREA, PRODUCTION AND PRODUCTIVITY OF FOOD GRAINS DURING THE YEAR 2015-16, IN JORHAT DISTRICT.

(Area in hectares, Production in tonnes and Yield in tonnes/hectares)

Sl.no.	Crops	Area	Production	Productivity	P.C of Area
01.	Paddy	347.47	569.90	1.640	74.37
02.	Wheat	4.41	4.01	0.909	0.94
03.	Maize	7.86	9.43	1.200	1.68
04.	Mustard	44.95	38.20	0.850	9.62
05.	Sesame	7.49	3.96	0.529	1.60
06.	Lentil	14.98	7.74	0.519	3.21
07.	Sugarcane	2.67	8.19	3.067	0.57
08.	Potato	10.11	97.06	9.600	2.16
09.	Banana	10.40	155.68	14.970	2.23
10.	Areca nut	10.09	203.52	20.170	2.16
11.	Chilly	1.17	0.644	0.550	0.25
12.	Coconut	0.52	0.033	0.060	0.11
13.	Assam Lemon	1.12	11.28	10.070	0.24
14.	Gram	0.56	0.340	0.600	0.12
15.	Pea	0.31	0.177	0.570	0.07
16.	Kharif Vegetables	1.67	14.39	8.620	0.36
17.	Rabi Vegetables	1.42	10.95	7.710	0.31
Total		467.20			100.00

Source: Field Survey

It is revealed from the above table that there are many constrains which directly or indirectly affect the socio-economic development of Agricultural Peasants. It is therefore pertinent to analyse more about this case.

4.3. CONSTRAINS WHICH AFFECT THE AGRICULTURAL PEASANTS IN JORHAT DISTRICT

The agricultural production has been handicapped by many factors of varied nature in the study region. All these can, however, be conveniently classified under three broad heads like, Physical and Biological factors, Socio-Economic-Cultural complexes and Science & Technology.

4.3.1. PHYSICAL AND BIOLOGICAL FACTORS

Agricultural Productivity, to a great extent, depends on the physical and biological factors of natural environment. In a backward region like Jorhat, the poor farmers are badly exposed to some of the worse types of natural calamities as they are almost untouched by modern science and technology. The conditions that surround the region's agriculture are, in their net effect, unfavourable to rapid growth of production.

4.3.1.1. Flood: Assam as a whole and Jorhat district in particular, is a chronically flood affected region. The five development blocks under study area are subjected to annual floods by the Brahmaputra and its tributaries. As a result, there is heavy loss in terms of life and property and extensive damage to standing crops. Traditionally, the agricultural peasants of the region mainly cultivate kharif crops and unfortunately these crops are always affected by the summer floods.

The flood in Assam was caused by large torrential rains in the month of July, 2016. The flooding has affected 1.8 million people and flooding could be extended to the Kaziranga National Park and its adjoining districts. As of 1st August 2016, 28 people had been killed as a result of the flooding in 17 July, 2016, (a report by the state Disaster Management Authority). It is all because of the heavy rain falls in July 2016. Assam has received around 60% more rains in 2016 which is much more than it received in July 2015.

According to the District Water Resource Department, Jorhat, chronically flood affected area of the district is 4.5 thousand sq. Km. (2016), which is shown in table 4.11.

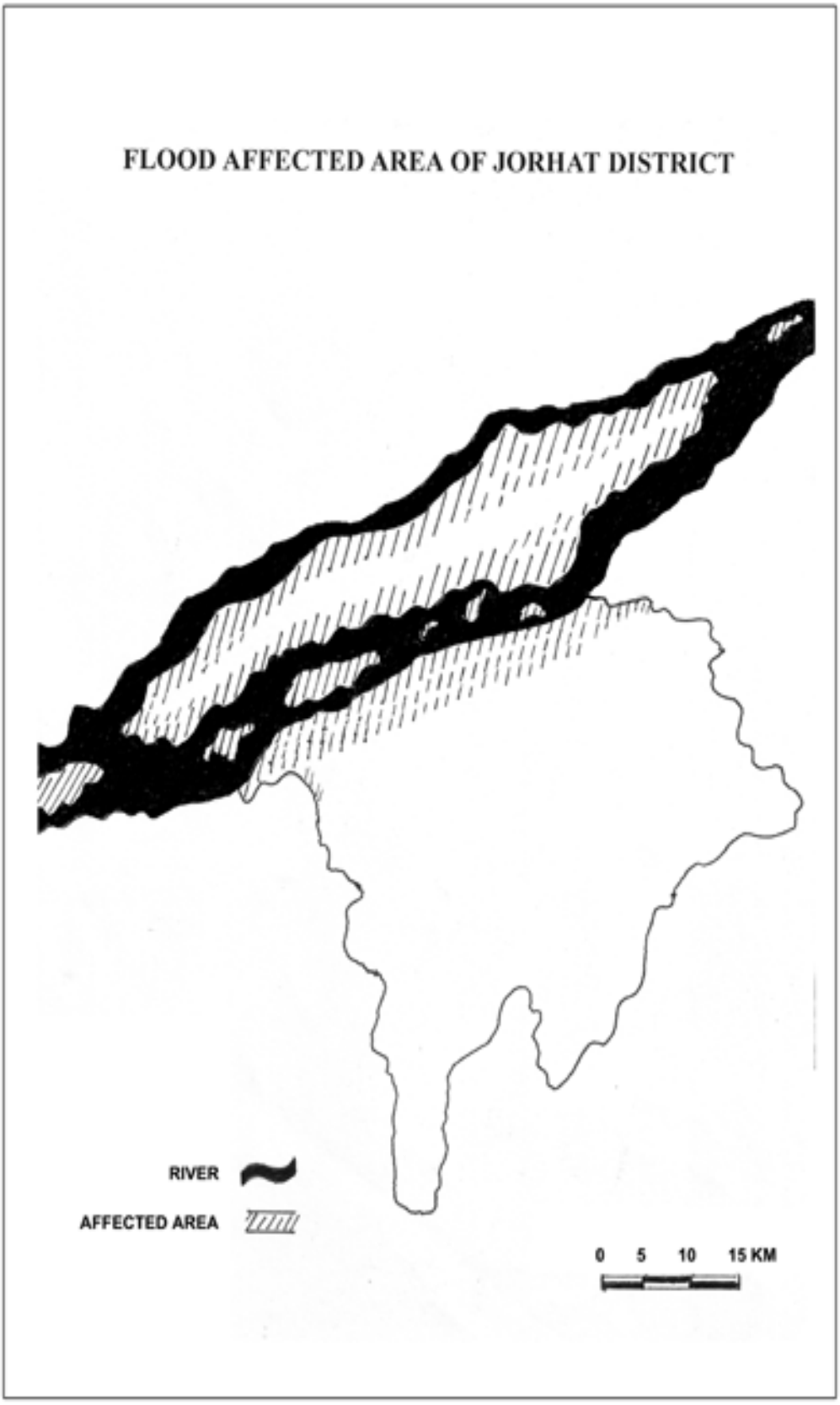
FLOOD AFFECTED AREA OF JORHAT DISTRICT
RIVER
AFFECTED AREA
0 5 10 15 KM

FIG 4.1

Table 4.11

AFFECT OF FLOOD IN DIFFERENT DEVELOPMENT BLOCKS OF JORHAT DISTRICT, 2016.

Sl.no.	Name of the Blocks	Total Area Affected (in Km^2)	Cropped Area affected (in thousand hectares)	Population affected (in thousands)	Human life lost.
01.	Dhekargorha	365	3.90	20	-
02.	Chipahikhola	850	6.43	50	01
03.	Kaliapani	385	4.84	30	-
04.	Ujoni Majuli	1400	7.28	80	02
05.	Kamalabari	1500	9.52	70	08
Total		4500	32.00	250	12

Source: District Water Resource Department, Jorhat, 2016.

Every year the district experiences three types of flood, depending upon the pattern and amount of rainfall, viz., early flood, normal flood and late flood. The damages caused by early flood are not very high in the district as it occurs in April and May which is not a regular feature. Usually, this flood causes damage to the summer paddy (Ahu) in the flood prone areas of the district. During June, July and August, the region experiences regular floods in the flood prone areas. This is the period of heavy rainfall in the district. Normal floods during this period cause extensive damage to the winter paddy (Sali). The occurrence of the late flood is of somewhat rare in the district, but it is the most disasterous flood in the region which occurs during September and October. Any damage to crops during this period is totally irreparable as winter paddy attains the mature stage in the region during this period.

4.3.1.2. Soil Erosion: Soil erosion is another severe problem faced by the agricultural peasants of the district. Problems of fluvial erosion are very severe along the river Brahmaputra and its tributaries. Because of severe flood and heavy rainfall, areas along the rivers are affected by soil erosion every year. Large amount of cultivable land as well as dwelling areas are eroded due to landslides every year along the

banks of the Brahmaputra and its tributaries. Ujoni Majuli and Kamalabari development blocks of Majuli sub-division is the worse sufferer of soil erosion and most of the peasants are rehabilitated in the grazing lands of the region every year.

4.3.1.3. Drought: Drought is another inhibitory physical factor that affects peasants and it has become a common phenomena to the region at present. Irrigation in the valley has progressed at a very low rate over the years. Therefore, the whole farming operation in the district depends on rain water, which is seasonal and very much erratic. More than 70 per cent of rainfall in the district is concentrated during the summer months. Even during the monsoon season, there are wide fluctuations of rainfall from time to time. Summer drought affects agriculture in the district more seriously. Due to summer drought seedling for winter rice (Sali) is delayed. Quite often, even transplantation of winter rice is also delayed due to drought which affects the growth of crops.

4.3.1.4. Animals, Pests and Diseases of Crops: Like in all other agricultural region of the country, in Jorhat district crops are damaged not only by floods, soil erosion and drought but also by insects, pests, diseases, weeds and animals. However, the actual damage caused by these factors has never been calculated so far.

It is estimated that 15 per cent of the total agricultural crops in India is destroyed annually by insects, pests and diseases, amount to a loss of Rs. 4500 million per annum.[48] Insects like Locust, Caterpillar, the Rice Grasshopper, the Army Worm, the Paddy Steamer, the Rice Hipster and the Rice Bug are responsible in varying degrees for the low yield of rice.

The humid tropical climate of the region with excessive relative humidity prevailing over a long period provides an ideal condition for the growth of insects. Rodents also cause severe loss of crops during the pre-harvest and post-harvest period. It is estimated that at least one-fifth of the crops produced are damaged by rats both in the fields and storages.

[48] Khadi Gramodhyog, Vol. 13, No. 1, 1960.

Besides these, domestic as well as wild animals are also responsible for the damage of crops to a large extend. Among the wild animals, birds and elephants are most important. The extent of damages by wild elephants is very severe and every year almost all the blocks of the district are suffering from this problem. This may be due to the severe deforestation in the district as well as the state, as a result of which, wild elephants use to come down to the plains in search of food and damage the standing crops.

Domesticated cattle and goats also damage crops to a large extent in the region. Most of the crop fields are open without proper fencing in the region. It is also difficult to raise fencing in the fragmented plots of agricultural fields of the peasants. Also due to the poor economic condition, peasants cannot erect permanent enclosures to protect their standing crops.

Weeds are also another problem in the region which lowers the agricultural productions. The varied species of weeds lowering the production in the district are Rumesmaridimus, Oryza fatua (wild rice) in the winter paddy fields and Cynadon dactylon, Cyperus rotundus in the summer paddy fields. Apart from these weeds of arable land, aquatic weeds like water hyacinth (Eichorina crassipes) is also a serious problem in the low lying areas where “Bao” rice “Sali” rice are cultivated extensively. It is estimated that 10 to 12 per cent of the summer rice and 8 to 10 per cent of the winter rice are damaged by weeds of various kinds in the district.

4.3.1.5. Poor Health of the Agricultural Peasants**:** Most of the peasants in the region usually live in villages. Due to unhealthy and poor living condition of peasants, they easily fall into various diseases. The diet taken by majority of peasants is not adequate to the required quantity or requisite quantity. They usually take rice as diet which is treated as an inferior cereals with little amount of pulses. Amount of green vegetables taken by farmers is very less. Milk, ghee, egg, fish, meat, etc., which contains high caloric value are taken very rarely by the peasants. As a result, the peasants are vulnerable to all kinds of diseases. Medical facilities provided by the Government to the peasants are not adequate as most of the Government Health Centres are not able to supply adequate amount of medicines. So, most of the people

die in the rural areas without detection of the diseases and lack of medical treatment.

4.3.1.6. Poor Health of the Draught Animals: Draught animals are the main power to traditional unmechanised agriculture in the district. Oxen and buffalo are the main work force used for ploughing. Compared to the number of draught animals the existing grazing lands in the district is very low. At the same time very little proportion of the arable land is devoted to fodder crops due to increasing demand of food grains.

In general farmers in the region take little care in feeding their cattle. Cows are generally let loose or allowed to graze in the grazing grounds. During the winter season, which is the rest period for cattle, they do not get sufficient food as the grazing lands are barren. The only fodder for cattle during this period is dry rice straw. During summer also most of the grazing lands are fully covered with Sali rice. Road sides, slopes and bank of embankments and playgrounds are the only grazing land for cattle in the summer season. As a result cattle are under-fed and ill-fed and most valuable cattle population suffer and die from various diseases and epidemic in large number.

4.3.2. SOCIO-ECONOMIC-CULTURAL COMPLEXES:

There are many social aspects which have a direct bearing on agricultural development in a particular region. Being an underdeveloped region, the peasants of Jorhat district has been working under various socio-economic constrains which are being discussed here.

4.3.2.1. Population Pressure: Due to the rapid growth of population, there is an excess pressure of population on the agricultural sector of the region. The traditional bound people and the historically given old attitudes of apathy and neglect towards the present lives are big hurdles of progressive in agriculture. Among the different sectors of the economy, agriculture accounts for the largest percentage of the working population in the district. Due to lack of industrial development, excess number of unemployed population engaged in the agricultural sector which is much

more than the actual requirement that creates severe waste of valuable manpower in the region.

4.3.2.2. Peasant Society: The way of life of the agricultural peasants in the rural society in the district is the outcome of various cultural, socio- economic, legal and political factors. The farming system carried out by peasants in the district is more a way of life than an economic proposition. Most of the peasant families in the district live in villages and are dependent on agriculture and only a few of them depend on secondary and tertiary sectors of the occupation. The villages consist of an average household of 100 in numbers. The villages are mostly surrounded by agricultural fields and in some cases; fields are located far away from their villages. Most of these farms are newly operated and mostly dominated by crops other than rice.

The social structure that comprises the village community in the region can be divided into following groups:

a) Farmers with own land who have hereditary right of tenancy and who fully or partly cultivate their land,
b) Sharecroppers with little own land,
c) Persons in professional services, and
d) Others.

The farmers belonging to first two groups cultivate their land with the help of family labour and in some cases with the help of hired labours. They are usually busy with winter rice cultivation for six months and the remaining six months of the year is rest period for them, except for few farmers who cultivate summer rice. The agriculture which they practise is of subsistence type with little or no surplus. They try to produce sufficient grains for the requirements to feed his family and domesticated animals, to meet their liabilities, to spend on social and religious festivals and functions and to educate their children.

The third group, consisting of mostly land-less agricultural labourers, is the poorest section of the community. They work on wage basis and during the off season they engage in other activities. The fourth section of the people are those

who are engaged in various professional services besides agriculture, and are economically well-off but a few in numbers. Beside these, some people in the villages are also engaged in occupation like shop-keepers, village artisans, money lenders, businesses, contractors etc.

The villages are surrounded by rice fields and these are usually high and dry land, free from flood. Farmers keep some amount of this dry and high land around their houses for the cultivation of crops other than rice which is locally known as 'Bari'. It varies from 0.5 hectares to 1 hectare in its size. Farmers cultivate varieties of crops in these lands like betel nuts and belel leaves, cytra fruits, vegetables etc. Usually farmers are busy in cultivating these crops when they are free from rice cultivation.

For the farmers who have little surplus or no surplus from the rice cultivation, these high land crops are the main source of their earnings for their every day expenditure and sustenance of the family. Usually they sell these products in nearby markets by themselves or through middlemen. Having mentioned so, the economic condition of agricultural peasants in rural areas is very poor. They hardly have cash savings. When they are in need of money, for medical aids, for educating their children, expenditure for various social and religious functions and ceremonies, for buying agricultural tools, draught animals or to build a house, they go to the middlemen and money lenders with whom they have business relation. In return they dispose off their agricultural products to them without getting reasonable price.

4.3.2.3. Law of Inheritance: The laws of inheritance and successions are governed by the social institution of joint family in rural societies. The Hindu as well as Muslim laws of inheritance ensure equal distribution of ownership of whatever share of land is available among all the male children of the family. No doubt, this trend creates a rural society consisting of independent of self-respecting peasants but a little scope for capital accumulation, large-scale of enterprise and high rate of savings. The most dangerous effect of law of inheritance in the region is the excessive fragmentation of landholdings as the holdings are already too small and fragmented. Almost all the family members who are in non-agricultural occupation are also entitle to get the

share of paternal land at equal proportions with their other cultivator brothers. Thus the law of inheritance is responsible for the creation of unfavourable scattered tiny plots of agricultural land in the region.

4.3.2.4. Religious Attitudes: Religious attitudes of peasants also affect economic growth and development of agriculture in the district. More than 79 per cent of the total population in the district is Hindu and almost 13 per cent is Muslim. Farmers are mostly dominated by superstitions, mystery, faith, taboos and resignation. The Hindu farmers are greatly affected by a variety of religious rituals and beliefs. A large number of holydays prohibiting ploughing and other agricultural activities has reduced the total working days even sometimes in the peak seasons. The money they received by selling some surplus crops after hard work are spent in various religious functions making their economic conditions worse.

4.3.3. SCIENCE AND TECHNOLOGY

Science and technology is a principal contributor to the development of agriculture. Full utilization of the potentials of land in the district cannot be achieved only by human and animal power with traditional method of farming. Due to lack of advance agricultural technique and technological change, agriculture in the district is still in subsistence level.

4.3.3.1. Fertilizer: Data on use of fertilizer in the Jorhat district for field crops are inadequate. Since the region has a large area under tea plantation, fertilizer sold in the region does not reflect actual quantity used in crops other than tea. Agriculture in the district is characterised by low consumption of chemical fertilizer. Consumption of fertilizer per hectare is only 1.59 kg. that is extremely low as against 53.28 kg. in Punjab and 3.15 kg. in Tamil Nadu. [49]

The low amount of fertilizer used by the agricultural peasants in the district may be ascribed to –

a) Large number of small and marginal farmers unable to purchase fertilizer at high price,

[49] Directorate of Agriculture, Assam.

b) Lake of irrigation facilities during rabi crop season,

c) Inadequate supply arrangement of fertilizer to rural farmers, and

d) Ignorance of the farmers.

4.3.3.2. HYV Seeds: The High Yield Variety (HYV) seeds can bring miraculous result in the field of agriculture, if irrigation is provided simultaneously. The Green Revolution in some states of the country was essentially the outcome of the extensive use of HYV seeds. Such a technological breakthrough is possible there because of the provision of assured water supply and the emergence of the big capitalist farmers. Unfortunately, the district is deprived of all such advantages.

Among the HYV crops, only the HYV of rice became popular among the peasants of the Jorhat district. HYV of rice such as IR-8, IN-1, "Monohar Sali" (locally developed), Aghuni Bora, Keteke Joha, Bahadur, Mashuri, Ranjit, Toria Var, TS-46, and TS-38 are grown in the district. Jorhat district is comparatively better position in use of HYV rice as compared to the other districts of Assam. It is due to the location of the Assam Agricultural University at Jorhat and a relatively high rural literacy in the district which facilitates the diffusion of this type of innovation in the district.

4.3.3.3. Mechanical Techniques: Mechanical techniques in agriculture are labour saving, capital-intensive and land-augmenting. A large number of workers engaged in agriculture can be taken away from land without any effect on production. But the displacement of labours should not stand in the way of agricultural mechanization. In such case proper manpower planning is quite necessary.

Large number of small landholdings and limited economic resources are hindered in the use of modern implements in agricultural field of Jorhat district. The use of primitive agricultural tools, drought animals with wooden plough in particular, is one of the manifold inefficiencies of agriculture in the region. Table 4.12 shows the distribution of density of wooden plough per 100 hectares of cultivation area in different blocks of Jorhat district.

Table 4.12

NUMBER OF WOODEN PLOUGH USED PER 100 HECTARES OF GROSS CROPPED AREA, IN JORHAT DISTRICT.

Sl. no.	Name of the Blocks	No. Of wooden plough per 100 hectares
01.	Titabor	78
02.	Selenghut	98
03.	Kaliapani	92
04.	Chipahikhola	95
05.	Baghchung	94
06.	Dhekorgorha	96
07.	Ujoni Majuli	98
08.	Kamalabari	97

Source: Field Survey.

NUMBER OF WOODEN PLOUGH USED PER HUNDRED HECTARES OF GROSS CROPPED AREA

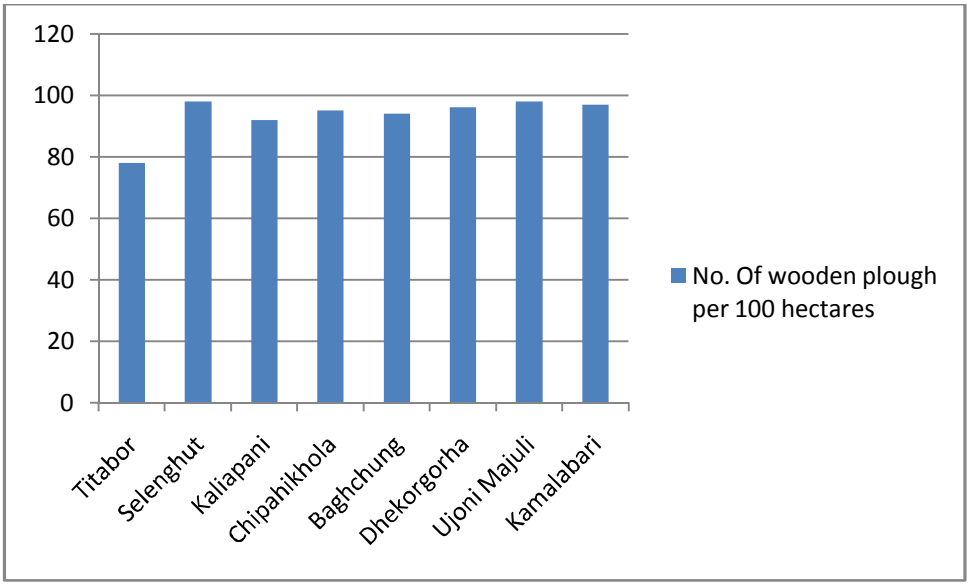

FIG 4.2

Block wise, Ujoni Majuli and Selenghut development blocks have recorded the highest number of wooden plough according to a density of 98 plough per 100 hectares of cultivated area, while Titabor development block has recorded the lowest number with a density of only 78.

4.3.4. INFRASTRACTURAL NEEDS

The economic condition of Assam till Indian independence was not at all satisfactory. The colonial rulers were interested only in tea, oil and coal industries of the state. The development of roads, railways and waterways in the state was undertaken to cater to the needs of the tea and oil industries and also for the administrative purpose. Thus after Independence, Assam has started undertaking development programmes in a traditional agriculture. Infrastructure is most essential for the modernization of agriculture through technological innovation. Due to the lack of proper infrastructural facilities the agriculture of Assam as a whole and Jorhat district in particular is still in subsistence level.

4.3.4.1. Irrigation

Irrigation is the most important infrastructural need in the development of agriculture and package of practices for intensive cultivation. High dependency of natural moisture and rainfall for growing crops means high degree of instability in agricultural production.

The rainfall situation in the district has already been described in the first chapter. The whole district is characterised by high rainfall and high humidity during the period of monsoon. Rainfall is extremely low during the winter months. Therefore, Rabi crops cultivation is very difficult in the region without irrigation. Slow progress in is adoption of multiple cropping by the farmers in the district can be attributed mainly to the absence of reliable and controlled source of water supply. The agricultural peasants of entire study area are mainly depending upon the natural sources of water like rainfall, rivers, stream, beels, lakes etc. Table 4.13 shows the available various natural sources of water area within the study region.

Data on irrigation in Jorhat district is very confusing. Neither seen irrigation project nor any govt. irrigation supply for agriculture within the study area. The total cropped area in Jorhat district is 152,900 hectares. Out of this only 152,248 hectares are irrigated lands, where only 0.43 per cent is irrigated paddy cropped area of the district. (Table 4.14).

Table 4.13

Water Available Area in Jorhat District (Area in hectare)

Sl.no.	Name of the Blocks	Ponds/Tanks	Beel	Swamp & low lying area	River	Derelict Water Body	Wet Paddy Field	Others
01.	Titabor	72.50	5.00	250.00	445.00	18.50	11400	130.00
02.	Selenghut	20.50	20.00	100.00	133.96	10.00	80.00	80.00
03.	Kaliapani	35.00	168.00	1665.00	122.00	86.00	90.00	18.00
04.	Chipahikhola	46.20	136.00	100.00	128.00	70.00	1285.00	10.00
05.	Baghchung	46.55	45.00	1890.00	120.00	90.27	285.00	150.00
06.	Dhekorgorha	78.20	230.00	1834.00	132.59	90.27	50.00	150.00
07.	Ujoni Majuli	298.90	135.00	272.47	5204.00	16.55	19.47	16.05
08.	Kamalabari	300.35	1383.00	367.50	13500.00	11.50	16.00	19.35

Source: Krishi Vigyan Kendra (KVK) Jorhat,2015.

Table 4.14

CROPPED AREA UNDER IRRIGATION

(Area in hectare)

Ahu	Sali	Early Ahu	Others	Non irrigated cropped area	Total cropped area
07	176	467	02	152,248	152,900

Source: Statistical Handbook of Jorhat, Assam. 2015.

Besides these natural sources of water, a few numbers of artificial sources of irrigation were seen during field investigation. (Table 4.15)

Table 4.15

SOURCES OF IRRIGATION IN JORHAT DISTRICT, 2015-16, (IN NUMBERS)

Sl.no.	Name of the Blocks	Canal	Tank	Tube well	Well	Others	Total
01.	Titabor	02	03	08	20	01	34
02.	Selenghut	01	01	06	10	0	18
03.	Kaliapani	01	02	05	11	01	20
04.	Chipahikhola	01	0	09	11	01	22
05.	Baghchung	03	04	11	22	02	42
06.	Dhekorgorha	02	02	07	13	01	25
07.	Ujoni Majuli	01	01	02	09	1	14
08.	Kamalabari	03	03	04	14	01	25
Total		14	16	52	110	08	200

Source: Field Survey.

4.3.4.2. Agricultural Marketing

Agricultural marketing in the region has been carried on by two types of market viz., free market and state controlled market. In the free market village trades or agents of whole sellers and millers operate in the village and village market is locally called hat. The whole sellers and millers operate in the terminal market usually in the urban centres where produce is sold locally or sent to other centres.

Marketable surplus of agricultural produce is the theoretical surplus available with the producer, left after his genuine requirements for disposal. Assam is highly deficient in the production of cereals as well as pulses and oilseed.[50] Most of the districts show a deficit in cereal production in Assam. But Jorhat district shows a little considerable surplus in cereals in the last few years. The district is also highly deficient in pulses and oilseeds. Almost all the pulses produced are consumed by farmers themselves. Formerly the farmers use to extract oil from their own production with the help of Ghani (an indigenous small device for pressing oilseed with the help of hand or bullock). At present this traditional practice has almost disappeared and oilseeds are sold to the millers (mostly non-Assamese) at very low price and edible oil is purchased by farmers at very high price.

4.3.4.2.(i). Free Market: In the free market, the marketed produce of the farmers goes from the rural areas to urban centres through a number of middlemen. These markets are not at all favourable to the farmers of the region as they do not get reasonable prices for their crops. After the harvest period, the middlemen collect crops from villagers at a very cheap price and sell it during the lean season, when prices rise. Sometimes, the poor farmers take loan from the middlemen, locally known as Bepari when they need money. In return, after harvest the middlemen realise their loans in terms of agricultural products at low prices.

It is observed from the sample villages that most of the farmers use to go to the nearby weekly markets only to purchase their essential commodities. A few farmers sell their products in the market by themselves. Most of the farmers dispose their marketable surplus at the source of Beparis. This is mainly because of the lack of patience, transport facilities and fear of being cheated in the market places and they gladly offer their produces to Beparis at a cheap price.

4.3.4.2.(ii). State Controlled Market: Marketing of agricultural produces continued to be in the hands of middlemen and traders. The marketing of paddy, the most important crop came under state control in 1960 when the Government established the Assam Co-Operative Apex Marketing Society. This institution played a vital role in

[50] Das. M.M., Peasant Agriculture in Assam. p. 277.

the procurement of paddy from 1960 to 1969. In 1969, the State Trading in paddy was abandoned. However, it was reimposed in the form of state takeover of the whole sale trade in paddy in November, 1973. It was accompanied by organisation of 665 Gaon Sabha level co-operative societies. These co-operative societies were entrusted with the task of procurement of paddy as the agents of the Food Corporation of India (FCI). The FCI and ACAMS took up the marketing of paddy in the state.

Inspite of such widespread coverage of paddy and rice marketing by the Government agencies, the open market has been playing a vital role in the procurement and distribution of crops. The performances of these institutions are not satisfactory because of high price of crops prevailing in the free markets than the Government controlled markets. As a result the procurement is not adequate for distribution among the consumers and, therefore, they depend heavily on the free markets where the price is much higher.

Thus it is observed that the quantity of crops sold to Government by farmers is almost negligible. This is due to low price offered by Government and also farmers are bound to sell their crops to the traders to repay their loans.

4.3.4.3 Agricultural Credit: The agricultural credit facilities to the farmers through various Government agencies and self help groups are encouraging in the region. It is mostly available in the secondary sectors. Whatever money is available as credit from any source the farmers spend it for purchasing other things than agricultural inputs. This is because of poor economic conditions of the farmers. Farmers are very needy and their needs are multiple such as purchase of food stuffs, construction and repair house, repay the old debts, for medical treatment, for education of their children, and for meeting the expenses of various social and religious festival.

The access to rural credit is provided by both Government and private agencies. The government agencies include Bondhan bank and Gramin bikash bank which are mostly popular in rural peasants. They also manage their money through different self help groups. But, these small amount of money would not be sufficient for them. A village survey of Kankhowa Gaon in Jorhat district reveals that 40 per

cent of the total loans were taken from the traders, 25 per cent from the village money lenders and the remaining from other sources. The agricultural peasants are compelled to dispose their agricultural products at a very low price in order to repay their loan just after the harvest of crops.

It is most essential to set up properly organised system of rural credit which must drive away the present defective credit system. Moreover, need of rural electrification for assured and abundant cheap power of irrigation, mechanical service centres for technological innovation and proper transport and communication system is necessary for the rapid growth of agriculture in the district.

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CHAPTER V

FARM ASSETS

5.1. INTRODUCTION

Assets of farm include farmland, personal residences, and other structures used in farming. It means all the assets of a farm or ranch including the residence out buildings, barns, irrigation system, trees and fencing. Farmland occupies a uniquely important role in the financial performance of agricultural production because of its dominance in the farm sector balance sheet. Farm real estate accounts for roughly 80 per cent of the total value of farm sector assets and it thus a major component of farm wealth. Farm wealth is an important indicator of household well-being. The distribution of farm household wealth is important for several reasons. First it affects the ability of farm household to efficiently allocate their farm business and household assets to earn the greatest return on their investment. Second, wealth influences contractual arrangement, including land leasing, tenure and management decision. Third, wealth can increase the efficiency of production and marketing contracts since well their operation may have access to superior contract that more closely match the operator's business objectives.[51]

There are special features of farmland that affect the financial viability and performance of farm operations. These include (1) a historically large capital gains/loss component in total returns to farm assets relative to current income, (2) low correlation with returns to other assets classes (3) irreversible development potential and non agricultural demands for agricultural land holdings. (4) the capitalization of government payments into land value, (5) uncertainty about the stream of policy benefits in the future and (6) the potential for asset price.

In this chapter, various assets of farms can be divided as (i) farm size, (ii) land use and cropping pattern, (iii) animal input, (iv) labour input, (v) non-land input, viz., machineries and implements, seeds, manure and fertilizer, irrigation and others, (iv) agricultural production.

Relationship between the farm size and productivity has been a controversial issue in Indian agriculture. While some economists argue in favour of 'inverse'

[51] Harris. J.M. (2010), "Agricultural Income and Finance Outlook" / AIS-88 / Dec-2009, Economic Research Service USDA.

relationship between the farm size and productivity, other attribute such a conclusion only certain 'statistical traps' and in turn suggest that, there exists no consistent relationship between productivity and size of operational holdings. There are still others who feel that the relationship tends to become positive, particularly in those areas receiving the impact of green revolution. Since the relationship between the farm size and productivity has an important bearing on various policies concerning agricultural planning adopted at the state or national level, it would be useful to utilize the latest data for testing various hypotheses.[52]

As the impact of green revolution in India was highly localized and emphasis on mere productivity had introduced acute socio-economic disparities, particularly in terms of land distribution among various segments of the population and in terms of changes in cropping pattern. The problem, perhaps, arises from the fundamental differences in the agricultural ecology of Jorhat district which allows differential relationship between agricultural farm size and productivity.[53] An attempt has been made to understand the relationship between different farm assets in a green ecological milue of Jorhat district in this chater.

This chapter will also intend to study the various inputs. Agricultural production and productivity are the functions of various inputs; therefore, production function approach of the study would be very much helpful for understanding the production increase in relation to its various factors which are assets of farm. Such factorial approach would also be in position to explain the significant degree of production factors influence by which the important results related to the operation of production process may be drawn for the balanced development and self-sustained growth of agriculture.[54] In fact, agro-ecological conditions and the size of land occupancy are the important basis for operations of the agriculture production processes because environmental condition has direct impact on crop-yield. Secondly, the size of landholding which is occupied by the

[52] Bharadwaj K. (1974), *Production Condition in Indian Agriculture*, p. 11.
[53] Ibid. p. 13.
[54] Bhagawati, K. (1974) *Production Function in Indian Agriculture*: A study based on Farm Management Survey.

farmers is also important to note because land is the piece of resource which are being utilized by the farmers.

5.2. FARM SIZES

Agriculture economy of a region depends much on the land distribution pattern and economic efficiency of the farming units depend much on the size of landholdings.[55] The questions pertaining to farm size, fragmentation and tenurial system are inextricably interlocked with the extent of productivity. It is, therefore, imperative to bring to focus the nature of their relationship with productivity as structure forces and examine their influences on the specific situation under study. While it must be remembered that these three factors are themselves interrelated, acting upon each other- the following account separately analyse each of this, only to have a clear understanding of the part.

There exists a strong relationship between inputs and outputs of a farm especially in relation to size of holding. One of the proposition which attracted considerable notice and has continued to record in discussion is the alleged inverse relationship between yield (i.e., value of outputs) per hectare and the size of holdings.[56] Even if such an inverse relationship holds, it does not provide a significant basis to judge the relative potentialities of the different size groups nor to predict the future pattern of size distribution that might emerge.

Despite these limitations, the inverse relationship acquired some significance as it could provide some rational for arguing that small farms are superior to large ones on purely economic grounds. Explanation that has been advanced so far in favour of superiority of small farms falls into three categories:

1. Differences in the techniques, the small holders using technically superior methods of production.

2. Qualitative differences in factor endowment, either land or labour on small farms is intrinsically of superior quality, and

[55] Das, M.M., *Peasant Agriculture in Assam*, Inter-India Publication, New Delhi.
[56] Ibid. of 2.

3. More intensive application of other co-operant inputs like labour, bullock power or irrigation.[57]

In the background of the above generalities it may be worthwhile to understand the distribution of farms in the sample villages as a prelude to understand its relationship with productivity. The total area occupied by 200 farms of the sample villages, is 467.2 hectare with average farm size of 2.3 hectares, which is significantly higher than the state average of 1.73 hectares. The table below shows the distribution of farms, cultivated area and average size of farms by farm size group of the sample households.

Table: 5.1

DISTRIBUTION OF FARMS, CULTIVATED AREA AND AVERAGE SIZE OF FARMS BY FARM SIZE GROUPS (Area in Hectare)

Farm Size (Hectare)	No. Of farms	% of total no. of farms	Total cultivated area	% of cultivated area	Average size of farms
Marginal (0.01-1.82)	78	39	107.8	23.1	1.3
Small (1.83-2.43)	44	22	98.6	21.1	2.2
Medium (2.44-3.24)	56	28	119.4	25.6	2.1
Semi-medium (3.25-4.45)	14	07	64.7	13.8	4.6
Large (Above 4.45)	08	04	76.7	16.4	9.5
Total	200	100	467.2	100	2.3

Source: Field Survey.

It is clear from the above table that the marginal farm size category (0.01-1.82) has as many as 78 farms but occupies only 23.1 per cent of the total cultivated area with an average size of 1.3 hectare. The medium farm size category of 2.44-3.24 hectare contains 56 farms (28 per cent) with highest amount of area of about 119.4 hectare having average size of 2.1 hectares.

[57] Ibid.

Table: 5.2

PERCENTAGE DISTRIBUTION OF NUMBER AND AREA OF OPERATIONAL HOLDINGS, 2015-16 (Area in Hectare)

Sample Villages Size Class	No. Of Holding		Operational Area	
	P. C	C.F	P.C	C.F
0.01-1.82	39.0	39.0	23.1	23.1
1.83-2.43	22.0	61.0	21.1	44.2
2.44-3.24	28.0	89.0	25.6	69.8
3.25-4.45	07.0	96.0	13.8	83.6
Above 4.45	04.0	100.0	16.4	100.0
Total	100.0		100.0	

Source: Field Survey

It is evident from the above discussion with tables that the large size of farms are generally small in number, but they do occupy considerable proportion of the total cultivated area amounting to nearly a quarter of it. In fact, the largest two categories (above 3.25 hectares) of farm account for around 30 per cent of the total cultivated area while in terms of their number, they account for a meagre 11 per cent. On the other hand, the smaller holdings are too many in number but they account for an insignificant proportion of the total cultivated area. The situation arising out of it inevitably leads to the question of fragmentation.

5.3. FRAGMENTATION

The fragmentation of holdings in cultivated area is one of the most deteriorated factors in farm operation. Large number of small plots in cultivated area leads to considerable work of different inputs, viz., land labour and other important farm resources. According to Bhagawati, (1964), the poorer productivity of land on large holdings to the possibility that they may be characterized by higher degree of fragmentation of the plots constituting the holdings.[58] Such fragmentation of cultivated land are scattered over distances adversely affects the productivity per hectare. However, the intensity of fragmentation by the number of fragments per

[58]Bhagawati and Chakravarty, (1964),"Reports on West Bengal", p. 24.

hectare goes on decreasing with the increase in farm size.[59] Thus farms of bigger sizes are in a more disadvantageous position than the smaller farms as the former possess bigger fragments than the later.

The number of fragments per farm and per hectare of sample farms is given in the following table by farm size groups. It reveals that overall intensity of fragmentation per farm and per hectare is 3.21 and 1.28 respectively in the sample farms.

Table: 5.3

NUMBER OF FRAGMENTS PER FARM AND PER HECTARE

(Area in hectare)

Farm size group	Per Farm	Per Hectare
Marginal	2.79	2.01
Small	3.21	1.45
Medium	3.62	1.35
Semi-Medium	2.33	0.88
Large	4.12	0.72
All farms	3.21	1.28

Source: Field Survey.

It is interesting to note that the number of fragments per farm is inversely related to farm size groups. This means that the number of fragments per farm is higher in the case of smaller farm sizes and is less in the larger farm size categories. But conversely, the number of fragments per hectare shows to be higher in the case of larger farm holdings and less in the smaller farm size holdings. Thus it may be concluded that the smaller holdings have greater fragmentation level per hectare but fewer fragmentation per farm. The case is reversed in the case of larger farm size.

[59] Ibid. op.cit.

5.4. OWNERSHIP OF FARMS

Tenurial conditions in India vary markedly from region to region and within region. Holdings can be classified broadly as wholly owned, partially rented and fully rented holdings. The intensity of cultivation, input costs, the cropping patterns, etc. are highly affected by the tenurial system.

A purely owned cultivator can undertake the provision and maintenance of irrigational facilities permanently, where a partial rented or fully rented cultivator may not be willing to do so. In other words, wholly owned farmers mostly working on their own fields, generally take greater take interest in performing their task and in better management.[60] Tenurial system may also have considerable influence on cropping pattern. The share-rented lands have a higher percentage area under food crops and less under cash crops as compared with owner cultivated and fixed-rented holdings."It is possible that a sharecropper is reluctant to venture into the more profitable, but risky crops, which, incidentally, also generally require a high level of inputs since he has to share the profits with the land lords".[61]

As the ownership of sample farms has been divided into two broad categories, viz., (i) purely owner cultivated, and (ii) share cultivated farms, it is found that out of the total cultivated areas about 94.05 per cent is owned by the farmers in the sample farms. Out of 200 farm families covered in the study as much as 94 per cent are purely owners' cultivators. Only 6 per cent of the holders come under the category of tenant cultivator.

There are only 12 families in the sample villages who work as share cultivators. Among these 12, category wise 2, from first size class groups (0.01- 1.82), 3, from size group of 1.83 – 2.43), 5 from size group of 2.44 – 3.24 hectares and 2 from semi medium group, i.e. 3.25-4.45 hectares.

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[60] K. Bhagawati, (1974), *Production Function in Indian Agriculture*: A study based on Farm Management Survey.
[61] Ibid.

Table 5.4

DISTRIBUTION OF FARMS, AREAS, WITH REFERENCE TO CATEGORY OF OWNERSHIP AND FARM SIZE GROUP

(Area in hectare)

Farm Size	Categories of Ownership				Total	P.C of owned to Total
	Purely Owned		Share- cropping			
	No.	Area	No.	Area		
0.01-1.82(marginal)	76	105.3	2	2.5	107.8	97.68
1.83-2.43(small)	41	95.3	3	3.3	98.6	96.65
2.44-3.24(semi-medium)	51	100.0	5	19.4	119.4	83.75
3.25-4.45(medium)	12	62.1	2	2.6	64.7	95.98
Above 4.45(large)	08	76.7	0	0.0	76.7	100.0

Source: Field Survey

It may be presumed from the above analysis that most of the families belong to owner cultivator category with marginal size of landholdings and everything remaining constant they must be taking requisite interest in cultivating their own land. In this regard, it is important to analyze cropping pattern to understand how the land is put under use.

5.5. LANDUSE AND CROPPING PATTERN

Land use and cropping pattern are the extent to which the arable land under different agricultural activities can be put to use. These largely depend upon the socio –economic influents which determine the possibility of the enterprise the farmer chooses and the input intensity with which he farms.[62] With an assured supply of water and availability of modern inputs specially high yielding varieties of seeds and commercial fertilizers- it becomes possible for the farmer to replace less profitable crops or enterprises with more profitable ones and also to enhance the intensity of the use of the available land by growing two or even three crops in the same field in a year.

[62] Singh, J. And Dhillon, S.S., Agricultural Geography – Tata McGraw- Hill Publishing Company Limited, New Delhi.

The qualitative differences in input, so far they exist, would be most predominantly reflected in the cropping pattern and intensive use of land. Then, differences in value productivity thus finally boil down to differences in intensity of land use and cropping pattern.[63] Apart from intensive land use, cropping pattern also contributes to the relative higher value productivity in smaller farmer. Intensive use of land, in turn, involves the application of other inputs to land.

Table 5.5

AVERAGE CULTIVATED AREA, CROPPED AREA AND INTENSITY OF CROPPING

(Area in hectare)

Farm Size (in hectare)	Average net cultivated area	Average gross cultivated area	Intensity of cropping
0.01-1.82 (marginal)	1.3	1.33	102.3
1.83-2.43 (small)	2.2	2.27	103.2
2.43-3.24 (semi-medium)	2.1	2.16	102.9
3.25-4.45 (medium)	4.6	4.66	101.3
Above 4.45 (large)	9.5	9.98	105.1
Total	2.3	2.31	100.4

Source: Field Survey

In cropping pattern, along with the intensity of cropping may explain a number of relations observed between input uses and the average size of holding which appears to hold for total crop production. The intensity of cultivation of general, however, shows a significant inverse relation to size of holding, declining sharply on large holdings. This probably explains the significant inverse relation between value productivity per hectare and the size of holding despite the higher value cash on large holdings.[64]

It is evident from the above table that the intensity of cropping in the sample villages is very low and it is lowest in the small size categories. On the other hand, interestingly, the intensity of cropping is high in case of large holdings. This indicates that small farmers in the region in most cases do not use their small plot of land intensively. However, this may not sufficiently indicate as to an inverse relationship

[63] Ibid. of 52, p.18.
[64] Ibid.

between size of holding and productivity which is a product of more complex factors. Therefore, it is necessary to supplement this vital clue with other indicators such as animal input, labour input, non-land input and income earned through sale of agricultural products.

5.6. VALUE OF ANIMAL INPUTS

To study about the socio-economic development of agricultural peasant, bullock labour plays an important part. Bullock has a multiple purpose use for peasants. It is a source of draught, a power used extensively in ploughing, irrigation, harvesting and transport operation. It is also a source of supply of manure to the peasants.

The figures for value of implements and machineries, as well as for "fixed capital" (which includes residences, wells, farm buildings, etc.) are very shakey. Implements can be mainly classified as 'traditional' and 'improved'.

It is found that use of improved implements in agriculture is quite negligible in the sample farms. Out of the total 200 farms, only 06 per cent farms used mechanical implements, i.e., Power tiller in farm operation. Bullocks are the source of power for farm operation for the rest of the peasants. There were in all bullocks in action in 200 farms in the sample villages, with an average of 2.2 bullocks per farm. It is also found that the average number of bullock is gradually increasing with the increase in farm size from 1.9 to 4.8. (Table 5.6)

Table 5.6

CATEGORY WISE USE OF DROUGHT ANIMALS IN THE SAMPLE FARMS

(Area in hectare)

Category	No. of holding	No. of bullock	Average
0.01-1.82(marginal)	78	150	1.9
1.83-2.43 (small)	44	88	2.0
2.43-3.24(semi-medium)	56	126	2.3
3.25-4.45(medium)	14	44	3.1
Above 4.45(large)	08	38	4.8
Total	200	446	2.2

Source: Field Survey

The overall value for the animal input in the sample farms is worked out at Rs. 4,800,000 with an average per hectare value of Rs. 10,273.9. It is observed from the table 5.7 that the per hectare value for animal input is highest in the lowest farm size group (0.01-1.82 hectare) which is decreasing with the increase in farm sizes and it is lowest in case of large size group which is only Rs. 3,911.3. This trend is quite obvious as big farms always get the advantage of using implements intensively at the same operation cost.

Table 5.7

CATEGORY WISE USE OF ANIMAL INPUTS IN MONEY VALUE

(Area in hectare)

Category	No. of holding	Area	Input (in Rs.)	Average Value (Rs./ hectare)
0.01-1.82 (marginal)	78	107.8	1,800,000	16,697.6
1.83-2.43(small)	44	98.6	1,000,000	10,141.9
2.43-3.24(semi-medium)	56	119.4	1,200,000	10,050.3
3.25-4.45(medium)	14	64.7	5,00,000	7,727.9
Above 4.45 (large)	08	76.7	3,00,000	3,911.3
Total	200	467.2	4,800,000	10,273.9

Source: Field Survey

5.7. VALUE OF LABOUR INPUT

Two types of agricultural labourers is found in the sample farms, viz., (i) family labour, and (ii) hired labour. The whole farming operation in sample villages is characterized by large number of family labour. Table 5.8 reveals that out of the total number of 443 labour employed, family labour is 307 in number which is about 70 per cent to the total labourers employed in the sample farms. Usually the number of labourers employed in agriculture (both family and hired labour) depends on the total number of family members available for agricultural work. But it is observed that the use of agricultural labourers depend upon the economic condition of the farmers in the sample farms. Large number of family members employed in agriculture particularly in marginal size farms is due to the poor economic condition of the farmers. It is also

observed in the sample villages that most of the family labourers employed in marginal size farms are of lower age group. They are mostly student and assisting their parents in agriculture beside their studies. It is also noticed from the table 5.8 that there is 77 per cent labourers who are engaged in smaller size farms, but per hectare use of labour is increasing with the increase in farm sizes. The per hectare use of labour in case of marginal farms (0.01-1.82 hectare) is only 1.9 persons. On the other hand, it is 4.8 persons in case of large group (above 4.45 hectare). The high average of per hectare labour use in case of large farms is due to comparatively better economic condition and also most of the family members of these farmers are engaged in the

Table 5.8

CATEGORY WISE USE OF HIRED AND FAMILY LABOUR IN SAMPLE FARMS

(Area in hectare)

Category	No. of holding	No. of family labour	No, of hired labour	Total	Average per farm
0.01-1.82 (marginal)	78	115	35	150	1.9
1.83-2.43 (small)	44	58	32	90	2.0
2.44-3.24(semi-medium)	56	80	30	120	2.1
3.25-4.45 (medium)	14	30	15	45	3.2
Above 4.45(large)	08	24	14	38	4.8
Total-	200	307	126	443	2.2

Source: Field Survey

secondary and tertiary activities. The average per hectare use of labour in agriculture for all the sample villages is 2.2 persons which can be regarded as more than actual requirement. It is obvious from the fact that, the whole agricultural system of the state is over populated i.e. , the number of people engaged in agriculture is more than the actual requirement, which is a severe waste of manpower resources.

Table 5.9

CATEGORY WISE USE OF LABOUR INPUT IN MONEY VALUE

(Area in hectare)

Category	No. of holding	Area	Input (in Rs.)	Value per hectare (in Rs.)
0.01-1.82 (marginal)	78	107.8	1,020,000	9461.9
1.83-2.43 (small)	44	98.6	887,200	8997.9
2.44-3.24 (semi-medium)	56	119.4	900,000	7537.7
3.25-4.45(medium)	14	64.7	450,000	6955.1
Above 4.45(large)	08	76.7	336,000	4380.7
Total-	200	467.2	3,593,200	7690.9

Source: Field Survey

The overall value of labour input in the sample farms is worked out at Rs.3, 593,200 with an average per hectare value of Rs. 7690.90. It is observed from Table 5.9 that the value for per hectare labour input is gradually decreasing from small farms to large farms. In case of size group of 0.01-1.82 (marginal) hectare, the value is Rs. 9461.90 and in case of large size group (above 4.45 hectare), it is Rs. 4380.70. It is due to the engagement of more number of family labours in agriculture.

5.8. VALUE OF NON-LAND CAPITAL INPUT

The value of non-land input in the sample farms is very low in comparison to other inputs. Table 5.10 shows that the total value of non-land input for all the 200 farms is only Rs. 960,000 with an average of Rs. 2054.8 only per hectare.

This only proves the traditional methods of farming system being practiced without modern techniques by farmers in the sample villages. The value of non-land input is lowest in the lower farm size group and gradually increasing with the farm sizes which is Rs. 3911 in case of biggest farm size group.

Table 5.10

CATEGORY WISE USE OF NON- LAND CAPITAL INPUT IN MONEY VALUE

(Area in hectare)

Category	No. of holding	Area	Input (in Rs.)	Average (in Rs./ hectare)
0.01-1.82(marginal)	78	107.8	150,000	1391.5
1.83-2.43 (small)	44	98.6	140,000	1419.8
2.44-3.24 (semi-medium)	56	119.4	220,000	1842.5
3.25-4.45 (medium)	14	64.7	150,000	2318.4
Above 4.45(large)	08	76.7	300,000	3911.3
Total-	200	467.2	960,000	2054.8

Source: Field Survey

It is observed during field investigation that modern irrigation is totally absent in all 200 farms and whole farm operation is depending on rain water. The amount of fertilizers used in the farms is also extremely low. Most of the HYV seeds for paddy used by the farmers are locally developed. Wooden ploughs are the only implements and bullocks are the only draught power in the sample farms. Only a few number of agricultural peasants used power tillers for farm operation in the sample farms. Except these few, some power tiller were used as Co-operative based which cannot be counted in individual house hold.

Comparatively high amount of non-land input value in case of big farms is only due to use of power tiller, more chemical fertilizers, insecticides and pesticides.

5.9. TOTAL VALUE OF INPUTS

The following table 5.11 shows the value of input per hectare.

Table 5.11

VALUE OF INPUT PER HECTARE

(Area in hectare)

Farm size	Animal input	Labour input	Non-land capital input	Total
0.01-1.82 (marginal)	16,697.6	9,461.9	1,391.5	27,551.0
1.83-2.43 (small)	10,141.9	8,997.9	1,419.8	20,559.6
2.44-3.24 (semi-medium)	10,050.3	7,537.7	1,842.5	19,430.5
3.25-4.45 (medium)	7,727.9	6,955.1	2,318.4	17,001.4
Above 4.45(large)	3,911.3	4,380.7	3,911.3	12,203.3
Total	10,273.9	7,690.9	2,054.8	20,019.6

Source: Field Survey

The average value of inputs per hectare is Rs. 20,019.6 according to the table 5.11, for all 200 peasant families in the region. An inverse relationship is clearly visible in respect of investment for all types and size of holdings. Thus the picture obtained by using per farm data is negated when the data per hectare is used.

5.10. AGRICULTURAL PRODUCTION

In most regions of India, small agricultural peasants seem to cultivate their land more intensively in the sense that they employ more labour and non-labour material inputs per hectare. Among the factors that permit small peasants to undertake more intensive effort are the cheap family labours, indivisibilities of capital, superior quality of land, quality of management that can be applied to a smaller farm, etc. Another factor is that most of the poor peasant families depend upon small piece of land without having any alternative means of income. Therefore, they try to maximize the output from the available piece of land. However, a poor peasant by his very position is at a disadvantage position compared to the bigger peasant in so far as his capacity to apply capital and other monetized inputs are concerned. As such even after all the efforts he can undertake, output per hectare on his farm may not be larger than the farm of bigger peasant.

The value of cash receipts in rupees from the sale of crops of the sample farms of the Jorhat district has been analyzed as an indicator of the efficiency of farm to understand the relationship between the farm size and productivity, which are the two main important assets of farm. The net receipts will indicate the value of the total inputs by farms as well as the socio-economic status of the sample households.

5.11. VALUE OF CROPS BY FARM SIZE AND PER HECTARE

As far as the farm size are concerned, it is observed that the cash receipts from the value of crops per holding sharply increases from small to bigger farm size groups in the sample farms (table 5.12). It is quite obvious that gross cash from the value of crops will be more in big holdings as they produce more crops. But percentage wise, the value of production is more in case of small farms as they are more in number.

Table 5.12

DISTRIBUTION OF CASH RECEIPTS FROM THE SALE OF CROPS BY FARM SIZE GROUPS

(Area in hectare)

Size Class	Total value(in Rs.)	Average Value per holding	Percentage
0.01-1.82 (marginal)	2,106,000	27,000	19.18
1.83-2.43 (small)	1,760,000	40,000	16.03
2.44-3.24 (semi-medium)	2,772,000	49,500	25.24
3.25-4.45 (medium)	1,568,000	112,000	14.27
Above 4.45(large)	1,936,000	242,000	17.62
Total-	10,982,000	54,910	100.00

Source: Field Survey

If we see the situation of cash receipts from the value of agricultural produce per hectare, it is interesting to note that there is proportionate increase. From the following table we can see that there is no such significant variation of cash receipts among the different farm size group.

Table 5.13

VALUE OF CROPS PER HECTARE IN RUPEES

(Area in hectare)

Farm Size	Average size of farm	Average receipt per hectare
0.01-1.82 (marginal)	1.3	19,536.2
1.83-2.43 (small)	2.2	17,849.9
2.44-3.24 (semi-medium)	2.1	23,216.1
3.25-4.45 (medium)	4.6	24,234.9
Above 4.45(large)	9.5	25,241.2
Total-	2.3	23,505.9

Source: Field Survey

Both the small and big farms sell surplus products. There is a tendency of slight increase of cash receipts with the increase of farm size but it is only because of high average size of farms in large categories and not because of higher productivity. It is also noticed that in small holding, i.e., size group of 1.83-2.43 hectare there is a little tendency of decreasing of cash receipts.

It may be concluded that there is a tendency for cash receipts per hectare of land to increase or to decrease or to remain unchanged as farm size increases. The present chapter provides an account of the various assets of farms that contribute to the socio-economic development of agricultural peasants in Jorhat district of Assam. It is imperative at the concluding part of this chapter to recount the broad observations made at several stages with the help of some quantitative techniques.

Table – 5.14

CATEGORY WISE PER HECTARE PRODUCTIVITY AND INPUTS IN MONEY VALUE

(Figures in Rupees: Area in Hectare)

Size Class	No. Of holding	Area (in hectare)	Average Production (per hectare)	Average Labour Input (per hectare)	Average Animal Input (per hectare)	Average Non-land Capital input (per hectare)
0.01-1.82 (small)	78	107.8	20769.2	9461.9	16697.6	1391.5
1.83-2.43 (marginal)	44	98.6	18181.8	8997.9	10141.9	1419.8
2.44-3.24 (medium)	56	119.4	23571.4	7537.7	10050.3	1842.5
3.25-4.45 (semi-medium)	14	64.7	24347.8	6955.1	7727.9	2318.4
Above 4.45 (Large)	08	76.7	25473.7	4380.7	3911.3	3911.3
Total -	200	467.2	23873.9	7690.9	10273.9	2054.8

Source – Compiled from Field Survey

Table 5.15

FARM SIZE, VALUE OF INPUTS AND OUTPUT

Farm Size	Value of total Inputs	Value of Output
0.01-1.82 (Marginal)	27,551.0	19,536.2
1.83- 2.43 (Small)	20,559.6	17,849.9
2.44-3.24 (Semi-medium)	19,430.5	23,216.1
3.25-4.45 (Medium)	17,001.4	24,234.9
Above 4.45 (Large)	12,203.3	25,241.2
Total	20,019.6	23,505.9

Source: field survey.

5.12. FINDINGS

In order to analyze the relationship between farm size and productivity the data as per farm cultivated area and per hectare productivity in terms of money value are utilized. It is seen from the table 5.13 that the small size farmers are comparatively more benefited than the big farms. The value of productivity per hectare of marginal farm size (1.3 hectares) reaches more than Rs. 19,000, as compared to the large farm size (9.5 hectares) Rs. 25,241. On the other hand, the productivity per farm increases as the farm size increases. As the size of 2.43 hectare reaches, the productivity per hectare increase to more than Rs. 17,000 and the size of above 4.45 hectares of productivity is more than Rs. 25,000. The table 5.14 also shows that the per hectare labour input and animal input increases as the farm size decreases which clearly suggests a negative correlation with the farm size group with labour input and animal input. The increase of non-land input per hectare with the increase of farm size suggests a strong association between these two.

The variation of different farm assets i.e., productivity in relation to various size of the farms indicate that agricultural productivity is increased with the diminishing rate when the farm size is increased. But the degree of variation among the distribution in the various farm sizes increased with the increase of the size of farmland. Increase in productivity with respect to increasing farm size may be due to

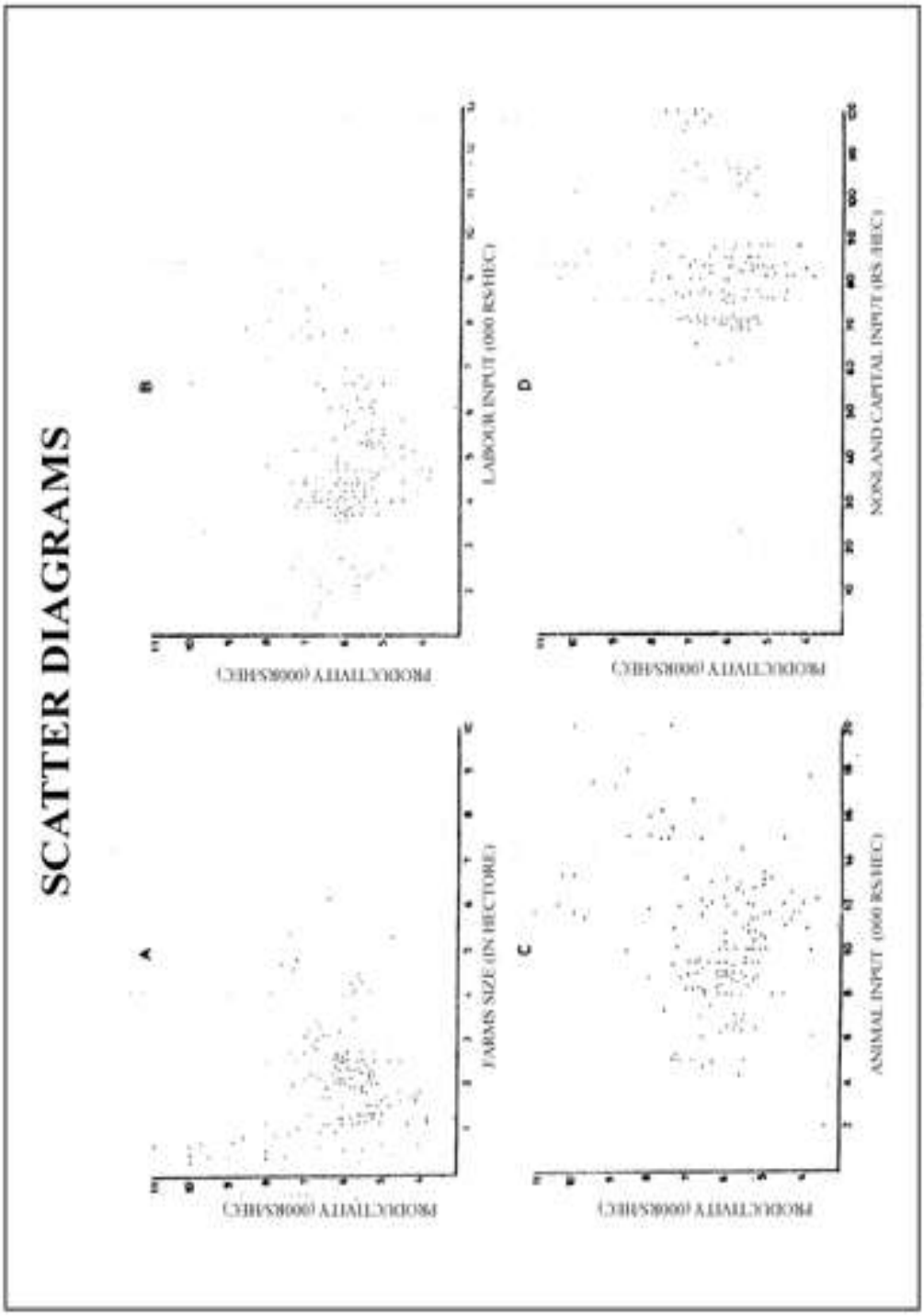
SCATTER DIAGRAMS
A
FARMS SIZE (IN HECTORE)
PRODUCTIVITY (000RS/HEC)
B
LABOUR INPUT (000 RS/HEC)
PRODUCTIVITY (000RS/HEC)
C
ANIMAL INPUT (000 RS/HEC)
PRODUCTIVITY (000RS/HEC)
D
NONLAND CAPITAL INPUT (RS /HEC)
PRODUCTIVITY (000RS/HEC)

FIG 5.1

induce technology which is being intensified at larger size of farmland, while the small farmland peasants are operate their piece of land with animal and labour forces.

The table 5.15 shows that the per hectare output (productivity) increases with the decreasing value of total inputs in respect to the farm size group. The maximum value of inputs seen in the small farm size groups and output is minimal. The case is inverse in case of large farm size groups. It reveals that there is serious misuse of family labour because of small farm size and most of the farmers do not use their small plots of farms intensively.

The productivity and labour input relationship shows that there is a negative relationship between them. The output and animal inputs relation are also insignificant in each and every sample farms.

The scatter diagram which is drawn by taking output and non-land capital attributes of agricultural production reveals that there is a positive relationship with a clustered distribution of the points of samples. However, in the few selected samples, the output per hectare is recorded low inspite of the intensive use of non-land capital inputs.

In the first phase, a Pearson's Correlation Coefficient of Multiple Regression is analyzed between average farm size as independent variable and average value of production as dependent variable which value is $R^2 = 0.73001$ (Appendix III), indicate the higher or very strong positive correlation. Hence, it is tested 0.05 or 5% significance level of confidence by student's 'T' test and the observed value found to be 17.34 against the critical value of probability from 'T' distribution of 12.71, means the hypothesis is rejected. However, to support this, an alternative hypothesis is to be considered between the value of total inputs as an independent variable and the total value of production (output) as a dependent variable. Here, the 95% significance level of confidence by student's 'T' test, to take a rejection level (∞) where the critical value in 'T' distribution is 1.96 against the observed value 1.04, i.e., the hypothesis is accepted.

In order to have a clearer picture of socio-economic development of agricultural peasants, the productivity and inputs pattern analysis of correlation coefficient is essential. In the second phase, coefficient of correlation by Rank

Difference Method (Rho) is used between the inputs of variables (i.e. productivity, non-land capital input, animal input and labour input) are tested in order to experiment the degree of association, (Apendix II). The table 5.16 showing correlation coefficient between the variables reveals that high degree of correlation exists. It also shows that a greater positive correlation between productivity and non-land capital input, as well as it shows a greater negative correlation between productivity with animal and labour input. At the same time, it describes a perfect correlation between animal input and labour input.

Table 5.16

CORRELATION BY RANK DIFFERENCE METHOD

	Y	X_1	X_2	X_3
Y	1	+. 9	- . 9	- . 9
X_1		1	- 1	- 1
X_2			1	+1
X_3				1

Correlation: $(YX_1) = +0.9$, $(YX_2) = -0.9$, $(YX_3) = -0.9$
$(X_1X_2) = -1$, $(X_1X_3) = -1$, $(X_2X_3) = +1$

It is clear from the above analysis that there are various drawbacks among the agricultural peasant which stands as barrier on proper socio-economic development. Maximum numbers of agricultural peasant are having lack of minimum requirement of education. Therefore they ignore of modern scientific method of cultivation. Moreover, the infrastructural facilities mainly irrigation system is almost absent within the district. They are not aware about the HYV seeds, use of modern technologies etc. This analysis firmly proved that proper socio-economic development is possible when the importance and investment in agricultural technology get the priority.

CHAPTER VI

SUMMARY AND CONCLUSIONS

6.1. SUMMARY

Agriculture is the backbone of Indian economy. In India, around 70 per cent of the people earn their livelihood from agriculture. It fulfils the basic need of human beings and animals. It is also the most extensive form of human occupation where half of the world's population earns its livelihood. The word "Agriculture" comes from a Latin term "Agercultura" which has its origin in the words "ager" means a field and "cultura" means to culture or cultivate. That means the word agriculture is the science or the art or the practice of large-scale soil cultivation in order to produce crops. The etymological meaning of the phrase "agricultural geography" is the description of the art of large- scale soil cultivation with reference to natural environment and human circumstances. Thus agricultural geography, dealing with the spatial organisation of crops and their concentration, provides an interesting field in which geographers can play a vital role for well being of the society.

The term peasant proprietors were frequently used to describe the traditional rural population in countries where small holders formed much of the land. More generally the word 'peasant' is and long has been often used to refer to poor or land less farmers and agricultural workers especially in the poorer countries of the world in which the agricultural labour force make up a large percentage of the population.

Peasant farming has been described as small scale farming for subsistence as well as for cash sale in the market. In different parts of the world, small farmers produced crops for domestic use as well as for sale in the market. However, after 1860, these farmers began to export their crops.

On characteristics of undeveloped agricultural peasants is self-sufficiency. Farm families in those circumstances consume a substantial part of what they produce. While some of their output may be sold in the market, their total production is generally not much larger than what is needed for the maintenance of the family. Not only is productivity per worker is low under these conditions but yields per unit of land are also low. Even where the land was originally fertile, the fertility is likely to have been depleted by decades of continuous cropping. The

available manures are not sufficient and the farmers cannot afford to purchase them elsewhere.

The socio-economic development of agricultural peasants without structural changes is a difficult task. This difficulty is more pronounced in countries with high population growth and high pressure of population on land. All these have contributed to a regional disparity or regional imbalances in the rate of growth of crop output and productivity. This aspect has drawn the attention of both the agricultural planners and scholars and it is now accepted that the various national level plans and programmes would be limping without proper location of specific schemes and plans on the basis of agricultural regions.

India's Geographical condition is unique for agriculture because it provides many favourable condition, viz. Plain area, fertile soil, long growing season and wide variation of climatic conditions. Assam in general and Jorhat in particular is also rich in various natural resources and has a strong agro-climatic base for agricultural peasants. But its economy as well as agriculture is not showing satisfactory performances. A low level progress in the primary sector of this region has resulted in slow socio-economic development. Agriculture is the principal source of livelihood for majority of the people in the Jorhat district. Yet agriculture in the district is on subsistence level and land is by and large below marginal. Though the district is under the fertile region of the state, the average yield of crops is much lower than some of the regions. Moreover, the district is not self-sufficient in food grains, though more than 70 per cent of the working population of the district is engaged in agriculture as their main source of livelihood. Every year the district has to import food grains from other states of the country to meet its domestic need. The study, therefore, is undertaken with a view to analyse the socio-economic development of agricultural peasants with its related problems and to examine the various assets of farm and its efficiency along with the physical and socio-economic landscape of the region which are closely related to the agricultural peasants.

Jorhat district is characterised by variety of physiographic features offering potentialities for development of agricultural peasants. At the same time it is also

imposing barriers to manpower efforts with unhealthy climatic condition, uncultivable hilly and wasteland, myriads of shifting water channels, extensive flood plain, etc. In such situation, without proper planning, systematic development of agriculture is a difficult task. On the other hand, the socio-economic landscape of the district is significant in character. The high population pressure on agriculture is another constraint for the development of agricultural peasants in the region. The low level development in the secondary and tertiary sectors and the ever increasing population in the region are bound to be absorbed in the agricultural sector. The district has different types of caste and communities under different religions contained high significant in socio-economic structure. The lack of minimum level of education among the peasant' and lack of knowledge on modern method of cultivation stands a grand challenge for peasant'. The district has remained industrially backward inspite of being endowed with rich natural resources, where only a small percentage of the total workers are engaged in the secondary sector. Though the district has sufficient numbers of markets, due to the lack of transport and communication facilities the peasant' are yet in subsistence level.

The apparent paradox arises because of a misunderstanding about the meaning of the word efficiency. It has nothing to do with productivity. The efficiency of a system means the ratio between the work or energy go out of it and the work or energy put into it. The more energy we get out per unit amount we put in the more efficient the system is. Theoretically, the maximum efficiency is when the energy put in is equal to the energy got out- such a system has an efficiency of 1 (or 100%). But in practice it is impossible to have efficiency as high as 1, because that would mean a perfect mechanism which had no energy losses at all.

Not all of this energy input is taken into consideration in comparing the efficiency of different food production system. The sun's energy is usually left out of the calculation, because it is assumed that in a given place it is constant, whatever the farming methods being used. Labour energy is sometimes left out as being negligible. Energy consumed in processing food and transporting it to the consumer is normally left out because it is not considered relevant. Only energy consumed within the boundaries of the farm is put into the calculations. Here, it is convenient to

leave out all of them apart from a nominal value for cropping pattern and agricultural land use on a simplified index of agricultural efficiency, which is the ratio of the energy in the crops produced in different cropping pattern, to the energy consumed on the agricultural land which is used to produce them.

Land use is the human use of land. It involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods. It also has been defined as the total of arrangements, activities and inputs that people undertake in a certain land cover type to produce change or maintain it. A more inclusive definition of land use in any given area of land is usually used to satisfy multiple objectives or purposes.

Cropping pattern is the pattern of crops for a given piece of land or cropping pattern means the proportion of area under various crops at a point of time in a unit area or it indicate the yearly sequences and spatial arrangement of crops and follows in an area.

The efficient cropping patterns of a region or areal unit may be determined on the basis of areal strength of individual crops. The first, second and third ranking crops of an areal unit may be called as the dominant crops of that unit. These crops if occupying more or less the same percentage of the total cropped area shall be competing for area with each other and the farmer will decide which crop may fetch him more profit in a given year under the prevailing rainfall and demand, supply and commodity price condition.

To calculate the efficiency of farms, the land use and cropping pattern in Jorhat district was taken into consideration. Relative Yield Index is being used to calculate the efficiency of different farms in the district. Here the land is considered as an areal input unit and crops (productivity) are taken as output unit. Out of the three major crops of Jorhat district, paddy and mustard farms are efficient in terms of Relative Yield Index. The percentage of sugarcane is little below the margin i.e., 88.7 per cent only. The total land area available for cultivation was only 24.41 per cent in Jorhat district in 2011-12, with a limited scope for physical expansion. Area sown

more than once is extremely low with only 13.78 per cent in the district to the total area. The cropping pattern in the region is characterised by high percentage of paddy hectareage, low average yield rate and low intensity of cropping. More than 76 per cent of the total cropped area under field survey is dominated by food grains and paddy alone occupying 74.37 per cent out of the total cropped area (467.2 hectares) under field investigation in Jorhat district. Mustard, the second large crop is 9.62 per cent of the total cropped area under field survey.

Land is the basic, fixed and limited natural resource. Land plays the key role in the determination of man's economic activities as well as social and cultural progress. All agricultural, animal and forestry productions depend on the quality and productivity of the land. The entire terrestrial eco-system which comprises of soil, water and plant are survived on the land resource. It meets the demand of food, energy and other needs of livelihood.

The landholding pattern of any agrarian society is generally complex and dynamic and its degree of dynamism primarily depends on the socio-economic, cultural and political systems. The primary socio-economic-cultural factors which contribute to the development of agriculture in an oriental agrarian society are: (i) land ownership (ii) fragmentation and land tenure problems (iii) limitation imposed by size of an operational holding. Land ownership has been change to Individual ownership or community ownership when agricultural land becomes scarce under the increasing burden of farm households on arable land. These systems of ownership have built in superior and inferior proprietorship. Certain classes, however, enjoy superiority over the cultivators who till the land. The majority of cultivators of land are the inferior proprietors in the agricultural set up. Others, such as tenants and lessees, have a transferable right to cultivation subject to a fixed rent in kind or cash, but the ownership of land is vested in superior proprietors, that is landlords.

There are no reliable written records on land tenure system in Assam before the Ahoms came in to the state. During their six hundred years of ruling, very lately they introduced certain land tenure system. When Assam was brought under the domain of British Empire in 1826, they began to frame certain land regulations. The Assam Land Revenue Regulation 1886 is the general revenue law of Assam and for

the first time it defined the rights to be attached with the owners of different classes, which is still in force. However, the land tenure system prevalent in the Jorhat district has been classified in to two types: Zamindari and Raiyatwari system. In the Zamindari system, revenue is collected by the Zamindars who acquired the status of a landlord. But under the Raiyatwari system, the occupiers pay revenue directly to the Government.

After Independence, a number of land reform measures have been taken by the State Government in order to remove the defects in the existing land tenure system. Among them, the Assam State Acquisition of Zamindari Act, 1951, the Assam Fixation of Ceiling on Land Holding Act, 1965, the Assam Consolidation of Holding Act, 1960, the Assam Bhoodan Act, 1965 and the Assam (Temporarily Settled Areas) Tenancy Act, 1971, are most important. The Assam State Acquisition of Zamindari Act, 1951, aimed to establish direct relationship between tenants and Government abolishing the right of Zamindars. The Assam Fixation of Ceiling on Landholding Act, 1965, aimed at reducing the glaring inequalities in the ownership of land and to satisfy the desire of the land less to possess land, this Act fixed 150 bighas (20 hectare) as the maximum limit of the holding. The Assam Consolidation of Holding Act 1960 seeks to consolidate the fragmented holdings and to prevent further fragmentation for better cultivation in the plain districts of Assam. The Assam (Temporarily Settled Areas) Tenancy Act was enacted in the year 1972. This act recognises two types of tenants, viz., occupancy and non-occupancy tenants. It reduced the length of time for acquiring the right of occupancy to 3 years instead of 12 years under ceiling regulations. According to this act, the occupancy tenants can acquire the right of ownership over land by depositing an amount of 50 times more than the annual land revenue payable. The Assam Bhoodan Act, 1965, is expedient to facilitate the donation of land received as bhoodan in response to Bhoodan Jajna movement initiated by Acharya Vinoba Bhave and to provide for regularisation, distribution and settlement of such lands to the landless persons and it provide for matter ancillary.

An operational holding in agriculture is defined as all the land which is used wholly or partially for agricultural production and is operated as one technical unit by

one person alone or with others. The peasant farmer's settlement in Jorhat district is surrounded by innumerable operational holdings of different shapes and sizes. The average size of operational holdings in the district is only 1.03 hectares. It is slightly higher average of operational holding in the district only because of the existence of large number of tea gardens. If the plantation estates are excluded from the total operated area, the actual average size of farms will go down to below one hectare in the district. The concentration of a large proportion of agricultural land in the hands of a minority of land owners, leaving more than 86 per cent of bottom holdings, below 2 hectares, to spread over only 35.46 per cent of the total operated area.

The whole operational holdings in the district are dominated by four categories of workers, i.e., cultivator, agricultural labour, workers in household industry, and other worker. Category wise average area of workers in operational holdings is only 0.43 hectares in the district as per 2011 census. It is interesting to note that the numbers of cultivators are more than the agricultural labours in the Jorhat district but holding per hectares is less than the agricultural labours. It may be due to the involvement of family labours in agricultural sector. Another notable feature is that the maximum size of operational holding of the district in terms of workers is 77 per cent in agricultural sector. The percentage of last two categories in size of operational holding is negligible. The distribution of operational holdings in the district is also occupied by high caste people, i.e., other than Schedule Tribes and Schedule Castes groups. Interestingly, the percentage of Schedule Caste farmers in the district is only 6.96 per cent which is less than the actual percentage of the Schedule Caste population of the state. The highest number of schedule caste operational holdings is 1.91 per cent followed by Dhekorgorha development block where the size of operational area is 2.03 per cent. On the other hand, the highest number of Schedule Tribes holding is 3.70 per cent followed by Ujoni Majuli development block where the size of operational area is 5.18 per cent occupied mainly by Mising Community.

The landholding pattern of eight development blocks under Jorhat district is significant in quality. According to 2011 census, out of the total 2.36 lakh holdings of Jorhat district 2.08 lakh holdings is considered in total holdings and from the total of 2.85 lakh sq. Km., only 2.15 lakh sq. Km. is considered to total operated area. It has been occupying with 75.64 per cent of the district's total area possesses 88.20 per cent of the total number of holdings. The block level, variation is found in the Jorhat

district in terms of both number of holdings and operated area. In some blocks of the district, the proportion of operated area were found to be lesser than their respective proportion of number of holdings and some other blocks this cases is inverse. But the district of Jorhat with relatively low population density has more proportions of area operated than the proportion of number of holdings in relation to the state's total.

The relatively large number of holding in Baghchung development block, Titabor development block and Dhekorgorha development block are mainly due to the existence of huge number of holdings of tea garden. On the other hand, out of the eight development blocks, Baghchung development block is industrially developed. So numbers of holdings are increasing day by day.

Similarly, the high size of operated area under Kamalabari development block, Titabor development block and Baghchung debelopment block is due to the introduction of plantation agriculture and the gradual change of agricultural practices from subsistence agriculture to sedentary.

The average size of farm in the district is 1.03 hectare which is slightly higher than the state's average of 1.02 hectare in 2011. The average size of farm is lowest in the Baghchung development block which is only 0.52 hectare. On the other hand, the highest average of farm size is found in the development block of Kamalabari with an average size of the farm 1.91 hectare.

Agriculture is the cultivation of animals, plants and fungi for food, fiber, bio fuel medicinal plants and other products which are used to sustain and enhance human life. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization.

Agriculture is one of the main components for the sustainability of human civilization. The production of agriculture is slowly shifting its focus to create goods that are safe for society and the environment. Those interested in using science to positively impact society and the environment may consider systematic study of agricultural production.

Having mentioned so, the Agricultural development of Assam in general as well as Jorhat district in particular is still subsistence level and land is by and large below marginal. Though the district is located in the fertile region of Brahmaputra valley, the average yield of crops is much lower. The district is not self-sufficient in

food grains, though more than 70 per cent of the working population of the district is engaged in agriculture as their main source of livelihood. Every year the district has to import food grains from other parts of the state to meet its domestic need.

Varieties of crops are grown in the Jorhat district in different seasons in varied land and climatic situation. Among these crops, food grains are the most important crops which are cultivated in the entire district. Paddy is the main crop of the district and it is cultivated in three different seasons of the year. The production of total paddy in Jorhat district in 2014-15 was 27.10 lakh quintals and the average yield of paddy was 29.38 quintals per hectare.

The intensity of cropping in the district is also extremely low. The average yield of paddy during the field investigation was 1.64 tonnes. The winter paddy (Sali) is the dominating crop in the district. It is observed that the autumn paddy (ahu) and summer paddy (boro) had low productivity growth. The productivity rate of winter paddy (Sali) is significantly high and area under this crop is also very high with compared to others two crops. This is only because of introducing high yielding varieties of seeds with sufficient rainfall during the sowing and transplanting months. It may be mentioned that the scope for bringing more area under this crop is very high in the district in view of the fact that most of the land under winter paddy could double cropping. However, the area under summer paddy is significantly low, according to the KVK report 2014-15. But the productivity of summer paddy is comparatively satisfactory with the limited area of production. This is primarily because of proper irrigation facilities and introducing high yield verities of seeds. Therefore, there is high scope to cultivate more area under this crop with sufficient irrigation facilities. Also in the traditional method of farming, higher output can be obtained by adopting crop-rotation.

It is revealed through the field investigation that the production of paddy in Jorhat district is 5.7 hundred tonnes for 2015-16. The average productivity of paddy in the district is 1.64 tonnes per hectares. Out of the eight development blocks of Jorhat district, the highest amount of paddy output is recorded in Titabor development block which is 1.45 hundred tonnes where the average yield is also maximum in 2.02 tonnes per hectare.

The production of wheat is negligible and the area under this crop is also very small. The area under wheat in Jorhat district was only 5.2 hundred hectares and the total production was 600 quintals (60 tonnes) in 2014-15 where the average productivity of wheat was 12 quintals/hectares of the area.

Besides Paddy and Wheat, Maize is another important food grain in Jorhat district. It occupies the second position after paddy in terms of area as well as production. It can be cultivated in almost all the blocks of the district. The area under maize cultivation is 7.86 hectares as per the field survey, 2015-16 which is 1.68 per cent to the total sample cropped area in the district. The total production of maize in the district is 9.4 tonnes, where the productivity is 1.2 tonnes /hectare. The highest production of maize is seen in Kamalabari development block which is 2.842 tonnes and productivity is 1.400 tonnes/ hectare.

Besides food grains, a large number of oil-seeds are grown in the district. Mustard is the principal oil-seed and it is also the second largest crop of the entire region in terms of area. The area under mustard cultivation is 44.95 hectares in 2015-16 which is 10 per cent to the total sample cropped area of the district. The total production of mustard in the region is 38.21 tonnes (38000 kg.) where the productivity is 850 kg per hectare of area. Block wise, Kamalabari development block having the highest amount of land under this crop is with a low yield of 808 kg.

The study highlighted that Sugar cane is the most important fibre crop production in the district. Area under sugarcane in the study area is 2.67 hectares which is only 0.57 per cent to the total sample cropped area of the region. The total production of sugarcane in the district is 8.2 tonnes whereas the productivity is 3.067 tonnes (3067 kg.) per hectare.

Besides these agricultural crops, a large number of horticultural crops and varieties of miscellaneous crops are grown in the entire study area viz., Potato, Banana, Areca nut, Chilly, Coconut, Assam lemon, Gram, Pea, Kharif vegetable, Robi vegetable etc.

It is however regretful that the agricultural production has been handicapped by many factors of varied nature in the study region. All these can, however, be conveniently classified under three broad heads like, Physical and Biological factors, Socio-Economic-Cultural complexes and Science & Technology. Under physical and

biological factors, flood, soil erosion, drought, animals, pests and diseases of crops, poor health of agricultural peasant' and poor health of the draught animals etc., can be considered. However, population pressure, peasant' society, law of inheritance and religious attitudes etc., can be included under the socio-economic- cultural complexes. On the other hand, fertilizer, HYV seeds, mechanical techniques are under the factors of Science and Technology. Similarly, infrastructural needs are irrigation, agricultural marketing and agricultural credit etc.

The small farmers in the district are almost untouched by modern methods of agricultural and technology. As a result of which, farmers are badly affected by some worse natural calamities. The entire study area is chronically flood affected region. As a result, there use to be heavy loss in terms of life and property and extensive damage to standing crops.

Unfortunately the data on irrigation in Jorhat district is very confusing. Neither seen irrigation project nor any govt. irrigation supply for agriculture within the study area. Drought is becoming a common phenomenon to the district. Irrigation in the district, which completely owned by the agricultural peasant's, is insufficient. The whole farming operation is dependent on rain water. Summer drought affects agriculture more seriously as more than 60 per cent of rainfall in the district is concentrated during the summer season. It is recorded that almost 21 per cent of the cropped area is affected by flood per year to the total cropped area of Jorhat district.

Further, the agriculture is also affected by diseases, insects, weeds and domestic as well as wild animals in the district. The humid tropical climate of the district with excessive relative humidity prevailing over a long period provided an ideal condition for the growth of insects, diseases and weeds. Domesticated animals as well as wild animals do damage to a large extent as most of the crop fields are open without proper fencing in the region. It is difficult to raise fencing in the fragmented and scattered small fields and also due to the poor economic conditions of the agricultural peasants; most of the farmers cannot erect permanent enclosures to protect their standing crops. Besides wild animals, birds also cause damage to the crops as the number of bird population is high in the district. It is revealed that the damage caused by wild elephants is more severe in the entire study area, as whole district is touched by the foothills of Nagaland and there is Gibbon Wildlife Sanctuary in the southern part of the district.

Due to unhealthy condition of living in the villages of the district, agricultural peasants easily fall into various diseases. Generally, foods items taken by the peasants are not adequate and most of these are inferior qualities. The free medical facilities provided by the Government are not adequate as most of the Government health centres are not in a position to supply adequate amount of medicines. So, most of the people died in the rural areas without detection of the diseases and due to lack of medicines.

The agriculture in the district suffers due to the poor health of draught animal. The existing grazing lands in the district are very low with compared to the number of the draught animals. Also the agricultural peasants take little care in feeding their cattles. Cattles are generally let loose to graze. During the winter season, which is the rest period for cattle, they do not get sufficient food as grazing lands are almost dry and barren. During summer season, most of the grazing lands are fully covered with winter crops (Sali). Roadsides, slopes and bank of embankments and playgrounds are the only grazing land for cattle in the summer season. As a result cattle are under-fed and ill-fed and the most valuable cattle population for poor peasants suffers and die from various diseases and epidemic, making the farmers socio-economic condition worse.

It is revealed from the field study that peasants in the district, are entirely depend on the agriculture. A few of them depend on secondary and tertiary sectors of occupation. As well as the social structure that comprises the village community in the district can be divided into four groups. Farmers, belonging to the first group cultivate their own land with the help of hired and contract labours. They are usually busy with winter paddy cultivation for six months and the remaining six months of the year is rest period for them, except for few agricultural peasants who also cultivate summer paddy. They try to produce sufficient grain for the requirement like to feed their family, to meet their liabilities from the sale of surplus grain. The second group of farmers with little own land, share others land for cultivation to fulfil their required demands of food grains. The third group consisting mostly of landless labourers are the poorest section of the community. They work on wage basis in the paddy field and during off season they engage themselves in other activities. The fourth group of people are those who engage themselves in various professional

services, besides agriculture, and are economically well off but of few in number. Besides these, some people in the villages are also engaged in occupation like shopkeeper, village artisans, money lenders, businessmen, contractors, etc. Apart from the paddy fields, villages are also characterised by some remaining high land in which peasants build their houses with cultivation of various cash crops, mainly betel nut, betel leaves, cytras fruits, vegetables, etc. Usually peasants use to be busy in cultivating these crops when they are free from paddy cultivation. For the farmers who have little or no surplus from paddy cultivation these high land crops are the main sources of their earnings for their day to day expenditure.

The economic condition of the agricultural peasants in the rural areas is very poor. They hardly have cash savings. They use to go to the middlemen or traders or money lenders when they are in need of money. It is done mostly for medical aids, for educating their children, expenditure of various social and religious functions and ceremonies, and also for buying agricultural tools, draught animals or to repair their houses, etc. In return, they have to dispose off their agricultural products to them immediately after the harvest even without getting reasonable price.

The law of inheritance ensures equal distribution of land property among the male child of the family in the rural society of Assam. However, the most dangerous effects of law of inheritance are the excessive fragmentation of operation holdings in the district.

Having studied so, religious attitudes of peasants also affect economic growth and development of agriculture in the district. More than 79 per cent of the total population in the district is Hindu and almost 13 per cent is Muslim. It is observed that farmers are mostly dominated by superstitions, mystery, faith, taboos and resignation. The Hindu farmers are greatly affected by a variety of religious rituals and beliefs. A large number of holydays prohibiting ploughing and other agricultural activities has reduced the total working days even sometimes in the peak seasons. The money they received by selling some surplus crops after hard work are spent in various religious functions making their economic conditions worse.

Science and technology is a principal contributor to the development of agriculture. Without science and technology full utilization of the potentials of land in the district cannot be achieved only by human and animal power with traditional

method of farming. Due to the lack of this technological change, agriculture in the district is still in subsistence level and farmers are economically very poor.

Data on use of fertilizer in the Jorhat district for field crops are inadequate. Since the region has a large area under tea plantation, fertilizer sold in the region does not reflect actual quantity used in crops other than tea. The consumption of chemical fertilizers in the district is extremely low with only 1.59 kg., per hectare is used. The use of HYV seeds can bring miraculous result if irrigation is provided simultaneously in the field of agriculture. Among the HYV crops, only HYV paddy becomes popular among the farmers in the district. But in few places, HYV crops are used in horticultural production too.

Large number of small operational holdings and limited source of economy hinder the use of modern implements in the agriculture. Bullocks and wooden ploughs are the main agricultural tools in the district. Ujoni Majuli and Selenghut development blocks have recorded the highest number of wooden plough according to density of 98 ploughs per 100 hectares of cultivated area, while Titabor development block has recorded the lowest number with a density of only 78 ploughs.

It is pertinent to mention here that without proper Infrastructure facilities for the modernization of agriculture through various other means is a difficult task. Irrigation is the most important infrastructural need in the development of agriculture and package of practices for intensive cultivation but this kind of facility is very limited in Jorhat district. Neither seen irrigation project nor any govt. irrigation supply for agriculture within the study area. The total cropped area in Jorhat district is 152,900 hectares. Out of this only 152,248 hectares are irrigated where only 0.43 per cent area is irrigated paddy cropped area of the district.

Agricultural marketing in the region has been carried on by two types of market, viz. free market and state controlled market. But the market system in the district is mainly dominated by free markets. The marketable surplus of the agricultural peasants goes from rural areas to urban areas through a number of middlemen. After harvesting, the middlemen collect crops from villages at a very cheap price and sell it during the lean season, when price fluctuate and rises up.

The agricultural credit facilities to agricultural peasants are extended by Government agencies and self help groups which are taken as encouragement. Whatever money is available as credit from any source the peasants spend it in purchasing other things than agricultural inputs. It all happens due to poor socio-economic condition of the agricultural peasants. Rural credit is provided by both Government and private agencies. The government agencies include Bondhan bank and Gramin bikash bank which are mostly popular among the rural peasants. They also manage their money through different self help groups. But, these small amount of money is never sufficient for them. A village survey of Kankhowa Gaon in Jorhat district reveals that 40 per cent of the total loans were taken from the traders, 25 per cent from the village money lenders and the remaining from other sources. The agricultural peasants are compelled to dispose their agricultural products at a very low price in order to repay their loan just after the harvest of crops. Therefore, it is most essential to set up proper organised system of rural credit which must drive away the present defective credit system.

For proper socio-economic development of agricultural peasants, the rural electrification system must be improved. There is high need of total rural electrification for assured and abundant cheap power for irrigation, mechanical service centres for technological innovation and for rapid growth of agricultural sector in the district. Moreover, present transport and communication system must be improved for socio-economic development of agricultural peasants.

The socio-economic development of agricultural peasants depends much on the land use and cropping pattern, farm crops efficiency of the farming units and the size of operational holdings. The questions pertaining to farm size, fragmentation and tenurial systems are inextricably interlocked with the extent of productivity. A macro-level study of 200 farm families in the district through field survey reveal a better land distribution pattern with an average farm size of 2.3 hectare, with 78 farms in marginal group in farm size 0.01-1.82 hectares and in large farm size group it is above 4.5 hectares with 08 farms.

According to the sample household survey, smaller holdings have greater fragmentation level per hectare but fewer fragmentations per farm. The case is reversed in the case of large holdings. On the other hand, the intensity of cultivation, input costs, the cropping pattern, etc., are highly affected by tenurial system. Out of the total 200 farmers of the sample households, 97.68 per cent of them are purely owner cultivators. Therefore, farmers can avail themselves of the advantage for better management of their own field. The intensity of cropping in the sample farms is very low, which is only 100.4 and it is lowest in the medium size category. This indicates that agricultural peasants in the district in most cases do not use their small plot of land intensively.

The use of mechanical implements in agriculture is quite negligible in the district. Out of the total 200 farms, 12 numbers of peasants used power tiller in farm operation. Bullocks are the main source of power for the rest of the agricultural peasants. The average value for animal input per hectare in the sample farms is Rs. 10,273.9 which is highest in marginal category with Rs. 16,697.6. Small peasants are in most disadvantageous position in animal input as minimum two bullocks are required for farm operation, whatever the amount of land may be.

It is observed from the sample household survey that a large number of family labours are employed in the whole farming operation. The engagement of large number of family labours employed in agriculture particularly in small farms are due to poor economic condition of agricultural peasants and due to lack of other alternative works. It is also noticed that most of the family labours are of small age group. Majority of them are students who assist their parents in farming operations besides studies.

The traditional methods of farming system are being practiced by farmers in the sample villages due to lack of modern techniques. The value of non-land input is lowest in the lower farm size group and gradually increasing with the farm sizes which is Rs. 3911 in case of biggest farm size group. Value of non-land inputs is extremely low in sample farms. Modern government irrigation facilities are totally absent in all 200 peasants farm. Use of chemical fertilizer is extremely low and most of the HYV seed used by the peasants are locally developed.

The study highlighted that the per hectare productivity of big farms, i.e., above 2.44 hectares is showing slightly better performances than the small farms. In terms of input and output relation, the smallest category of farms, i.e., below 1.82 hectares is showing loss, whereas the other categories of farms are showing marginal profits. The reason behind low efficiency of small farms are no doubt due to the expenditure incurred on animal inputs and family labours which is much higher than the actual requirement.

6.2. CONCLUSIONS

The study may be concluded with the following suggestions:

1) To develop the socio-economic condition of agricultural peasants, raising production by putting more and more land under agriculture is not at all encouraging if emphasis is not given on raising productivity. Horticultural expansion of arable land is limited in the region and further expansion at the costs of natural environment should be restricted. Efforts should be made to intensify the use of available land in order to achieve higher productivity of land.

2) The most important task will be to motivate the agricultural peasants for minimum level of education and to adopt scientific mode of cultivation. It is also important to motivate the peasants towards modern agriculture wide range of publicity and effective plans and programmes. All the service centres related to agriculture should be decentralised and located in rural areas. At the same time government should also make some concrete and definite rules. Double cropping or multiple cropping should be made compulsory. Agricultural peasants who are not willing for the second crop cultivation, the land should be handed over to other landless and willing peasants for the second crop.

3) The existing tiny and scattered operational holding distribution in the district is hindering the implementation of modern tools and machineries in agriculture. The only solution to this problem will be to consolidate the scattered landholding in every village under voluntary co-operative societies and government should provide free infrastructural facilities to these societies.

4) Irrigation is the key of success of all developmental efforts in agriculture. For the rapid growth of agriculture in the district, the installation of network of irrigation projects should get top priority. For the adaptation of improved agricultural practice, especially for cultivating HYV paddy in the winter months, provision of irrigation facilities is extremely necessary. If the irrigation facilities are made available, double or multiple cropping could be adopted and farmers in the flood affected areas can opt for crops that can be grown during flood free winter months.

5) The over burden of population in the district is resulting in waste and under utilization of manpower resources in agricultural sector. The deficit in input output relation in the case of small farms in the district is due to the excess number of family labours employed and higher expenditure in animal input. It is very much necessary to divert excess number of agricultural workers to other occupations such as cottage industries, weavings, poultry, other small scale food processing units by providing those proper infrastructural facilities.

6) Another constraint in socio-economic development of agricultural peasants in the district is poor health of the peasants and draught animals. As almost 70 per cent of the total population in the district live in rural areas, they are deprived of getting sufficient health care facilities. Though most of the government free health centres are shifted to the rural areas, there are insufficient medical facilities as well as doctors and nurse. So, proper medical facilities, sufficient medicine with medical stuff should be shifted to the rural area hospitals. Likewise, government should establish all veterinary hospitals in rural areas of the district instead of giving more concentration in the urban areas.

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APPENDIX I

RELATIVE YIELD INDEX

1. Relative Yield Index of **Rice**

$$RY = \frac{Y_0}{Y_{max}} \times 100$$

$$= \frac{1.62}{1.74} \times 100$$

= 93.1%

2. Relative Yield Index of **Mustard**

$$RY = \frac{Y_0}{Y_{max}} \times 100$$

$$= \frac{0.43}{0.53.} \times 100$$

= 90.6 %

3. Relative Yield Index of **Sugarcane**

$$RY = \frac{Y_0}{Y_{max}} \times 100$$

$$= \frac{34.7}{39.1} \times 100$$

= 88.75 %

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APPENDIX II

CORRELATION OF CO-EFFICIENT BY RANK DIFFERENCE METHOD

1. Correlation between Productivity and Non-Land Capital.

Average Productivity(Y)	R_1	Average Non – Land Capital (X_1)	R_2	Difference (D) R_1-R_2	D^2
19,536.2	4	1,391.5	5	-1	1
17,849.9	5	1,419.8	4	1	1
23,216.1	3	1,842.5	3	0	0
24,234.9	2	2,318.4	2	0	0
25,241.2	1	3,911.3	1	0	0
					$\sum D^2=2$

$$Rho = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$= 1 - \frac{6\times 2}{5(5^2-1)}$$

$$= \underline{+0.9}$$

2. **Correlation between Productivity and Animal Input**

Average Productivity (Y)	R_1	Average Animal input X_2	R_2	D= R_1-R_2	D^2
19,536.2	4	16,697.6	1	3	9
17,849.9	5	10,141.9	2	3	9
23,216.1	3	10050.3	3	0	0
24,234.9	2	7,727.9	4	-2	4
25,241.2	1	3,911.3	5	-4	16
					$\sum D^2=38$

$$Rho = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$= 1 - \frac{6\times 38}{5(5^2-1)}$$

$$= \underline{-0.9}$$

3. Correlation between Productivity and Labour Input

Average Productivity (Y)	R_1	Average Labour Input (X_3)	R_2	$D=R_1-R_2$	D^2
19,536.2	4	9461.9	1	3	9
17,849.9	5	8,997.9	2	3	9
23,216.1	3	7,537.7	3	0	0
24,234.9	2	6,955.1	4	-2	4
25,241.2	1	4,380.7	5	-4	16
					$\sum D^2=38$

$$Rho = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$= 1 - \frac{6\times 38}{5(5^2-1)}$$

$$= \underline{-0.9}$$

4. Correlation between Average Non-Land Capital and Average Animal Input.

Rank(R_1) of Non-Land Capital Input (X_1)	Rank(R_2) of Animal Input (X_2)	$D= R_1 - R_2$	D^2
5	1	4	16
4	2	2	4
3	3	0	0
2	4	-2	4
1	5	-4	16
			$\sum D^2=40$

$$Rho = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$= 1 - \frac{6\times 40}{5(5^2-1)}$$

$$= \underline{-1}$$

5. Correlation between Average Non-Land Capital and Average Labour Input

Rank (R_1)of Non-Land Capital Input (X_1)	Rank (R_2) of Labour Input (X_3)	D= R_1- R_2	D^2
5	1	4	16
4	2	2	4
3	3	0	0
2	4	-2	4
1	5	-4	16
			$\sum D^2=40$

$$Rho = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$= 1 - \frac{6 \times 40}{5(5^2-1)}$$

$$= \underline{-1}$$

6. Correaltion between Average Animal Input and Average Labour Input

Rank (R_1) of Average Animal Input (X_2)	Rank (R_2) of Average Labour Input (X_3)	D= R_1- R_2	D^2
1	1	0	0
2	2	0	0
3	3	0	0
4	4	0	0
5	5	0	0
			$\sum D^2=0$

$$Rho = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$= 1 - \frac{6 \times 0}{5(5^2-1)}$$

$$= \underline{+1}$$

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APPENDIX III

PEARSON'S CORRELATION COEFFICIENT AND STUDENT'S 'T' TEST.

Pearson's Correlation Coefficient (Linear Correlation Coefficients)

Category	Independent Variable(X) Farm Size	Dependent Variable(Y) Production	XY	X^2	Y^2
Marginal	1.3	19,536.2	25,397.06	1.69	381,663,110
Small	2.2	17,849.9	39,269.78	4.84	318,618,930
Semi-medium	2.1	23,216.1	48,753.81	4.41	538,987,299
Medium	4.6	24,234.9	111,480.54	21.16	587,330,378
Large	9.5	25,241.2	239,791.4	90.25	637,118,177
Total =	∑x=19.7	∑y=110078.3	∑xy= 464,692.59	$\sum x^2$= 122.35	$\sum y^2$= 2,463, 717,894

$$R^2 = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{\{n\sum x^2 - (\sum x)^2\}\{n\sum y^2 - (\sum y)^2\}}}$$

$$= \frac{5(464,692.59) - (19.7 \times 110078.3)}{\sqrt{\{5(122.35) - (19.7)^2\} \times \{5(2463717894) - (110078.3)^2\}}}$$

$$= \frac{154,920.44}{\sqrt{223.66 \times 201,360,000}}$$

R^2 = 0.73000857 or 73.001%

(Higher or very strong positive correlation).

Student's 'T' Test

$$T = \frac{(\bar{x}_1 - \bar{x}_2)}{Sp\sqrt{\left(\frac{1}{N_1}\right)+\left(\frac{1}{N_2}\right)}}$$

Where,

$\bar{x}_1$ and $\bar{x}_2$ are the means of the two samples,

N_1 and N_2 are the sample sizes,

Sp is a statistics known as the pooled estimate of variance, calculated as –

$$Sp = \sqrt{\frac{(n_1 - 1)S_1^{\,2} + (n_2 - 1)S_2^{\,2}}{n_1 + n_2 - 2}}$$

Where,

$S_1^{\,2}$ and $S_2^{\,2}$ are the variance of the two samples.

Table: 5.17 (Student's 'T' Test)

Category	Farm Size (X_1)	Deviation $X_1 - X_1$	$(X_1 - X_1)^2$	Production (X_2)	Deviation $X_2 - X_2$	$(X_2 - X_2)^2$
Marginal	1.3	- 2.64	6.9696	19536.2	-2479.46	6147721.89
Small	2.2	-1.74	3.0276	17849.9	-4165.76	17353556.40
Semi-medium	2.1	-1.84	3.3856	23216.1	1200.44	1441056.19
Medium	4.6	0.66	0.4356	24234.9	2219.24	4925026.18
Large	9.5	5.56	30.9136	25241.2	3225.54	10404108.3
Total	$\sum \bar{x}_1 = 19.7$		$\sum x^2 =$ 44.732	$\sum \bar{x}_2 =$ 110078.3		$\sum x_2^{\,2} =$ 40271469

$$\bar{x}_1 = \frac{\sum x_1}{N} = \frac{19.7}{5} = 3.94$$

$$\bar{x}_2 = \frac{\sum x_2}{N} = \frac{110078.3}{5} = 22{,}015.66$$

$$\text{SD or } S_1 \text{ or } \sigma = \sqrt{\frac{\sum x^2}{N}} = \sqrt{\frac{44.732}{5}} = \sqrt{8.9464} = 2.99$$

$$\text{SD or } S_2 \text{ or } \sigma = \sqrt{\frac{\sum x^2}{N}} = \sqrt{\frac{40271469}{5}} = \sqrt{8{,}054{,}293.8} = 2838.00$$

$\therefore$ $S_1^{\,2} = 8.9464$

$\therefore$ $S_2^{\,2} = 8054293.8$

$$Sp = \sqrt{\frac{(n_1 - 1)S_1^{\,2} + (n_2 - 1)S_2^{\,2}}{n_1 + n_2 - 2}}$$

$$= \sqrt{\frac{(5-1)8.9464 + (5-1)8054293.8}{5+5-2}}$$

$$= \sqrt{\frac{4 \times 8.9464 + 4 \times 8054293.8}{8}}$$

$$= \sqrt{\frac{32217211}{8}}$$

$$= \underline{2006.78}$$

$$T = \frac{(\bar{x}_1 - \bar{x}_2)}{Sp\sqrt{\left(\frac{1}{N_1}\right) + \left(\frac{1}{N_2}\right)}}$$

$$= \frac{(3.94 - 22015.66)}{2006.78\sqrt{\left(\frac{1}{5} + \frac{1}{5}\right)}}$$

$$= \frac{22011.72}{2006.78\sqrt{0.4}}$$

$$= \underline{17.34}$$

(Hence, the observed value is 17.34 against the critical value of probability from 'T' distribution is 12.71, means the hypothesis is rejected).

Student 'T' test for Alternative Hypothesis

Category	Total Inputs (x_1)	Deviation $x_1 - \bar{x}_1$	$(x_1 - \bar{x}_1)^2$	Production (x_2)	Deviation $x_2 - \bar{x}_2$	$(x_2 - \bar{x}_2)^2$
Marginal	27551.0	8201.84	67270179.4	19536.2	-2479.46	6147721.89
Small	20559.6	1210.44	1465164.99	17849.9	-4165.76	17353556.4
Semi-medium	19430.5	81.34	6616.19	23216.1	1200.44	1441056.19
Medium	17001.4	-2347.76	5511977.02	24234.9	2219.24	4925026.18
Large	12203.3	-7145.86	51063315.1	25241.2	3225.54	10404108.3
Total	$\sum x_1$= 96745.8		$\sum x_1^2$= 125317253	$\sum x_2$= 110078.3		$\sum x_2^2$= 40271469

$$\bar{x}_1 = \frac{\sum x_1}{N} = \frac{96745.8}{5} = \underline{19349.16}$$

$$\bar{x}_2 = \frac{\sum x_2}{N} = \frac{110078.3}{5} = \underline{22015.66}$$

SD or S_1 or $\sigma = \sqrt{\frac{\sum x_1^2}{N}} = \sqrt{\frac{125317253}{5}} = \sqrt{25063450.6} = 5006.34$

$\therefore S_1^2 = 25063450.6$

SD or S_2 or $\sigma = \sqrt{\frac{\sum x_2^2}{N}} = \sqrt{\frac{40271469}{5}} = \sqrt{8054293.8} = 2838.00$

$\therefore S_2^2 = 8054293.8$

$$Sp = \sqrt{\frac{(n_1 - 1)S_1^{\,2} + (n_2 - 1)S_2^{\,2}}{n_1 + n_2 - 2}}$$

$$= \sqrt{\frac{(5-1) \times 25063450.6 + (5-1) \times 8054293.8}{5+5-2}}$$

$$= \sqrt{\frac{100253802 + 32217175.2}{8}}$$

$$= \sqrt{16558872.1}$$

$$= \underline{4069.26}$$

$$T = \frac{(\bar{x}_1 - \bar{x}_2)}{Sp\sqrt{\left(\frac{1}{N_1}\right) + \left(\frac{1}{N_2}\right)}}$$

$$= \frac{(19349.16 - 22015.66)}{4069.26\sqrt{\left(\frac{1}{5} + \frac{1}{5}\right)}}$$

$$= \frac{2666.5}{4069.26\sqrt{0.4}}$$

$$= \frac{2666.5}{2573.626}$$

$$= \underline{1.04}$$

(Here, the 95% significance level of confidence by student's 'T' test, to take a rejection level (∞) where the critical value in 'T' distribution is 1.96 against the observed value 1.04 and the hypothesis is accepted).

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APPENDIX IV

SCHEDULE FOR VILLAGE SURVEY ON SOCIO-ECONOMIC DEVELOPMENT OF AGRICULTURAL PEASANT'S PERFORMANCE

BASIC INFORMATION

SOCIAL PROFILE

1. Name of the District:
2. Name of the Block:
3. Name of the Village:
4. Name of the Head of the family:
5. Name of the Respondent:
6. Sex: Male/Female
7. Age:
8. Religion:
9. Caste: General/OBC/ST/SC/Other
10. Family type: Nuclear/Joint/Extended family
11. Marital Status: Married/Unmarried/Widow
12. Total number of family members:
13. Family Tree with Educational Qualifications:

Sl. No.	Name of the family members	Sex	Age	Relationship with head of the family	Educational Qualification	Main Occupation

14. Type of houses:

Sl.no.	Type of houses	No. of houses	Total
1.	RCC/Semi RCC		
2.	Tin roof with brick walls		
3.	Tin roof with planks/bamboo		
4.	Thatch		
5.	Government quarter		
6.	Private rented		

ECONOMIC PROFILE

15. (A). Total area of land holding:
(B) Mode of cultivation:
a. Own land
b. Share Cropping
c. Rented land
(C) Types of Crops with Area and Production :

Crops	Area	Production	Weeding season	Date of sowing	Date of harvesting
Paddy: HYV/ Local					
Maize					
Wheat					
Gram					
Jute					
Sugar cane					
Oil seeds					
Vegetables					
Fruits					
Others					

16. Input supplied:

INPUTS	EXPENDITURE
Fertilizer	
Pesticides	
Weedicides	
Insecticides	
Others	

17. Farm Implements:

IMPLEMENTS	NO.	ESTIMATED COSTS
Wooden plough		
Tractor		
Thresher		
Harvester		
Bullocks		
Others		

18. Irrigation facilities:

MEANS OF IRRIGATION	AREA COVERD	ESTIMATED COSTS
Tube-well		
Well		
Tank		
River		
Stream		
Others		

19. Total return in quantity:

CROPS	QUANTITY	SOWING CAPACITY OF LAND
Rice		
Wheat		
Maize		
Gram		
Sugarcane		
Mustard		
Others		

20. Surplus/ deficit:

CROPS	SURPLUS	DEFICIT
Rice		
Wheat		
Maize		
Gram		
Sugarcane		
Mustard		
Others		

21. Labour Use:

KINDS OF LABOUR	NUMBERS.		WAGE RATE		TOTAL
	MALE	FEMALE	MALE	FEMALE	
Family labour					
Hired labour					
Contract labour					
Others					

22. Financialdifficulties:

23. Source of Finance:

(a) Bank
(b) Money lenders
(c) Others

24. Dissatisfaction, if any:

25. Nearest market and distance:

26. Land-use pattern:

Sl.no.	Types of landuse	Area (hectare)	Value (Rs.)
1.	Terrace land		
2.	Wet land		
3.	Plantation land		
4.	Forest land		
5.	Fallow/waste land		
6.	Accommodation land		
7.	Net sown area		
8.	Others		
Total Area/Value			

27. Cropping pattern:

Sl.no.	CROPS CULTIVATED	AREA UNDER CROPS
1.		
2.		
3.		
4.		
5.		
6.		

28. Methods of cultivation in past 10 years:

1 year back:

2 years back:

3 years back:

4 years back:

5 years back:

6 years back:

10 years back:

29. Government help:

DEPARTMENTS	KINDS OF HELP
1.	
2.	
3.	
4.	
5.	
6.	

30. Problems faced grievances and suggestions with respect to agriculture / schemes in the village:

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PLATES

Plate 01: Peasant busy ploughing in a small category farm.

Plate 02: Rice seedlings to till in large size farm.

Plate 03: Land ready to transplant paddy seedlings.

Plate 04: Both family and hired labours transplanting paddy seedlings.

Plate 05: Research scholar trying her hand during transplantation of paddy seedlings.

Plate 06: Transplantation in large farm.

Plate 07: A panoramic view of paddy field

Plate 08: An enhance beauty of paddy field.

Plate 09: Fully matured paddy for harvest.

Plate 10: Peasants deeply engaged in harvesting.

Plate 11: Mustard Cultivation.

Plate 12: A wonderful view of Mustard Crop.

Plate 13: Mustard and Sugarcane cultivation in Kamalabari development block.

Plate 14: Sugarcane cultivation in Majuli.

Plate 15: Research scholar in the Sugarcane field

Plate 16: Researcher during the data collection.

Plate 17: A home made machine to squeeze out juice from sugarcane.

Plate 18: Process by which sugarcane juice is boiled and converted to molasses.

Plate 19: Matured Lantils for harvest.