CHAPTER-10
SUMMARY OF FINDINGS, CONCLUSION AND SUGGESTIONS

The State agriculture department has given more focus of attention to increase production of food grains for providing food security to the growing population through the increase of productivity of crops and cropping intensity. Keeping this goal of the State in our view, the case for agrarian reforms and agricultural growth as the means for achieving broad based economic development of the State of Assam has been argued in the early chapters of the present study. The subsequent chapters have brought to fore the obstacles which are currently restraining the process of agricultural growth through the realization of potentiality of agricultural land in terms of crop productivity per unit area. The discussion traces the significant changes in the agrarian structure over the last four decades and the present state of agriculture in Assam and tries to examine whether the existing agrarian structure in the State is conducive to achieving higher agricultural productivity and growth. While analysing the aggregate characteristics of the agrarian structure and agriculture production, the main emphasis was put on the new strategy of agricultural development which emphasised the application of modern science and technology to agriculture supported by substantial investment in modern inputs and agricultural practices or operations. Given the cultivated land area, increase in the volume of agricultural production in the State can result from a number of factors such as agrarian changes i.e. institutional changes in the farm sector, increase in the cropping intensity of cropped area, shift in the cropping pattern in favour of the crops with higher productivity and application of improved agricultural technology based on modern science and technology. Our analysis has also indicated that most of the problems of agricultural growth in Assam can be addressed by suitable policy measures. So, the main purpose of this concluding chapter is to draw up a package of policy measures for accelerating the pace of agricultural development and growth in the State. Since this package must logically follow from the findings of the study, so a recapitulation of the findings would perhaps
be useful at this point. Thus, before drawing up the policy package, a summary of the principal findings and conclusions is presented here.

10.1 Agrarian changes at national level

A relatively low land-man ratio, unequal distribution of land ownership, a high degree of subdivision and fragmentation of holdings, predominance of small farms operated mostly by owner cultivators, the limited role of tenancy are among the distinguishing characteristics of the Indian agrarian economy. The two important aspects i.e. the distribution pattern of ownership and operational holdings are as follows.

10.1.1 Distribution pattern of ownership of land holdings.

- The broad, highly skewed nature of size–distribution of ownership holdings has by and large, remained unchanged over time, notwithstanding the progressively downward shift in the distribution. In other words, over a period of four decades since 1961-62, the size distribution of ownership holdings has progressively shifted downward.

- The size distribution of ownership holdings in India is characterized by predominance of landless households and marginal holders. During 2003, the marginal holdings and the landless constituted about 80% of the rural households but owned only 23% of total area. The medium and large holders accounted for only 3.6% of the households but had a combined share of about 35% in the total land owned by all households in 2003.

- The percentage of landless household which is 10% as estimated by the survey in 2003 is not very different from the estimated proportion for 1971-72 which was 9.6%. However, the landless proportion in 1982 and 1992 are the same i.e. 11.3% which is higher than the previous one.

- The proportion of marginal holders has risen from 66% in 1961-62 to 80% in 2003 and the proportion of small holders has increased from 9% to 11%. This rise in the proportion of marginal and small holders has been accompanied by a steady decline in the proportion of medium and large holders.
The increasing pressure of rural population on the limited land base is reflected in the steady decline in the average area owned per household over the years. In 1961-62, the average area owned per household was 1.78 hectare (including landless households). Gradually and steadily, it came down to 0.73 hectare in 2003. Excluding the landless households, the average area owned was estimated to be 0.81 hectare in 2003, which is nearly 40% of the estimate in 1961-62 (i.e. 2.01 hectare).

The average size of ownership holdings remained constant over the time period in the marginal size group, but declined in the other entire size group. The extent of decline increased with the increase in farm size group.

From the estimates for the period from 1961-62 to 2003, it is observed that there has been a sharp increasing trend in the total number of ownership holdings. The sharpest increase in the number of holdings is seen in the marginal size group, followed by small and semi-medium size group.

The area owned by the total ownership holdings shows a declining trend over the period from 1961-62 to 2003. The total area owned was 128.7 million hectare in 1961-62, which had fallen to 119.6 million hectare in 1971-72—a fall of about 7%. But, the area owned by the marginal size group increased very sharply over the years, while that by the small size group increased moderately and by the semi-medium size group increased marginally. This may happen due to sub-division of holdings and in case of marginal holdings, partly due to the distribution of government land. On the other hand, there has been a sharp decline in the area owned by medium and large size holdings. In large size group, it declined from 36.3 million hectare in 1961-62 to 16.2 million hectare in 1992. This may also be attributed to the sub-division of holdings.

Thus the general feature that emerges from the distribution of ownership holdings is that there is a rise in the percentage of ownership holdings in the lowest category and a decline in the percentage of holdings in the categories of semi-medium and upwards.

10.1.2 Distribution pattern of operational land holdings

The number of operational holdings increased rapidly from 51 million in 1960-61 to 101 million in 2002-03, which is understandable considering the growth of
population. However, the rate of growth of operational holdings, which accelerated over the three decades from 1960-61 to 1991-92, appears to have slowed down in the decade prior to 2002-03. The virtual disappearance of joint holdings has also made some contributions to the rise in the number of operational holdings. There were over 4% joint holdings in 1960-61. By 1970-71, the proportion of joint holdings had come down to a tiny fraction (0.6%).

- In India, a general feature of the size distribution of operational holdings is that the percentage of holdings decreases as the holding size increases. The percentage distribution of operational holdings reveals that the decline is getting progressively steeper with each decade. The percentages of large, medium and semi-medium holdings have been declining steadily since 1960-61.

- The trends in the number of operational holdings in different categories during the period 1960-61 to 2002-03 shows that number of operational holdings in different categories are not changing at the same rate or even in the same direction, over time. Over the three decades, the number of marginal holdings has multiplied from 19.8 million in 196-61 to 71.0 million in 1991-92—an increase of over three and half times. The number of small holdings, too, has been increasing, though at a much slower rate since 1970-71. As against this, the absolute number of large and medium holdings has declined steadily during this period.

- The total operated area of 133.48 million hectare in 1960-61 had dropped to 126 million hectare in 1970-71—a fall of about 5.8%. It dropped by around 5.6% again between 1970-71 and 1981-82. The estimate for total operated area from the 48th round showed a rise to 125 million hectare, that is, back to the 1970-71 level. However, in the survey of 59th round, the estimate is 108 million hectare which amounts to a fall of about 8% since 1981-82, that is consistent with the declining trend observed up to 1981-82, in the last 21 years. The overall fall over the 42 year period is about 18.5—which is roughly equivalent to a 5% fall every decade.

- The share of marginal holdings in total operated area, which was under 7% in 1960-61, has risen rapidly over the last four decades and increased by 6-7 percentage points since the last survey(1991-92) to draw the level with the shares of the semi-
medium and medium holdings (around 22.5%) at the time of the 59th survey in 2002-03. The share of small holdings too has been rising continuously and is now over 20%, while the share of large holdings has been steadily declining from 29% in 1960-61 to a level of 12-13%. The share of area operated by medium holdings has declined steadily but more moderately, and the share of semi-medium holdings appears to have reached its peak in 1991-92.

- The consequence of rapid growth in the number of operational holdings with a limited land base is clearly shown by the estimates of average area operated per holding. Over the four decades, the average size of a holding came down by nearly 60% --from 2.63 hectare in 1960-61 to 1.06 hectare in 2002-03.

- Fragmentation of holdings has been a chronic problem in Indian agriculture. The estimate available from the last four Land Holding Surveys shows that the average rural holding, though smaller, is less fragmented than it was earlier, the number of parcels per holdings having dropped from 5.7 in 1960-61 to 2.3 in 2002-03.

- The number of operational holdings has got considerably reduced as compared to the ownership holdings in all the rounds of NSS. In 1992, the number of land ownership households was 103.3 million as compared to the number of operational holdings of 93.5 million hectares, but the area owned was 117.35 million hectares as compared to the operated area of 125.10 million hectares. This difference in area would be due to leasing–in of land by operational holdings from urban households and non-household entities.

- The percentage distribution of operational holdings reveals that the decline is getting progressively steeper with each decade. The percentages of large, medium and semi-medium holdings have been declining steadily since 1960-61. The decline is steepest for large holdings i.e. from 4.5% to 0.8%. At the other end, there is a great crowding of holdings into the ‘marginal’ category in which the percentage of holdings has swelled from 39% in 1960-61 to 70% in 1991-92.

- It is important to note that there has been a sharp decline in the total number of operational holdings in the country from 93.45 million in 1992 to 89.35 million in 2003, indicating that about 4 million farmers have withdrawn from agriculture during
this period in search of an alternative occupation and these farmers seem to belong to all size group, those belonging to the size group 0.41—1.00 hectare, have shown a sharp increase. It appears that a section of farmers belonging to the size group less than 0.40 hectare shifted to the size group 0.41—1.00 hectare through the arrangement of land leasing. The latter size group also gained due to sub-division of holdings in higher size groups. As a consequence, the number of operational holdings in the marginal size group has increased marginally. Therefore, the real decline in the total number of operational holdings took place not only in all size groups, but also the extent of decline increased sharply with farm size. Thus; it is the farmers of this size group who have abandoned farming.

Under normal circumstances, this decline in the number of farmers would have been taken as a sign of economic development, whose pull factor would have drawn out farmers from agriculture to non-agricultural sector. Unfortunately, this does not appear to be the case, as there has been deep distress among the farming community during this period. It is likely that a good section of these withdrawing farmers were dependent on leased-in land whose profitability has sharply declined because of increase in rent and cost of production in the face of near stagnancy in yield.

10.1.3 Tenancy and ownership holdings

- It is seen that while only 4.1 million (2.8%) households reported leasing-out of land, 17.0 million (11.5%) households reported leasing-in. A leaser household could have leased out land to more than one leasee household. But there is a large difference between area leased-out (3.3million hectare) and area leased-in (7.6million hectare). It may be mentioned here that while collection of data on leasing-out of land was restricted to household ownership holdings only, that on leasing-in covered contracts involving land owned by urban households and non-household sector as well. The estimate of area (other than homestead) leased-in from rural households is about 6.6 million hectare. This indicates that there are reasons for difference between the estimates of area leased-in and area leased-out.

- The proportion of households leasing-in land and ratio of land leased-in to total area owned from the last three land holding surveys of NSS estimates reveals that
there is a declining trend in the percentage of households leasing-in land over the three decades. The ratio of area leased-in to area owned by households has dropped from 12% to 7% during the last decades and the ratio of area leased-out to area owned dropped from 6% to 3%.

10.1.4 Terms of lease and ownership holdings

- Lease contracts were mostly unrecorded, while 7.1 percent of the rural households reported leasing-in of lands (other than homestead), out of this only 0.7% reported recorded lease and 6.3% reported unrecorded lease. The area under recorded lease constituted only 10% of the total leased-in area, while it was 90% under unrecorded lease. It is seen that in rural India, a large majority of the contracts were share cropping and fixed rent in cash or kind. About 40% of the leased-out land was contracted for share of produce. The shares of rent in cash and rent in kind were respectively 31% and 15%. All other terms of lease together accounted for only 14%.

10.1.5 Trends and Extent of tenancy of land by operational holdings

- The number of tenant holdings was about 10 million and area of tenanted land was about 6.9 million hectares in 2002-03. The percentage of tenant holdings shows no clear pattern of variation with variation in holding size. In most of the classes shown, the percentage of tenant holdings varies between 9% to 12%. In the ‘large’ category of holdings, it was nearly 14% of tenant holding in 2002-03, but the lowest size class shows only 4.7% of tenant holdings which was much lower incidence of tenancy. However, the percentage of tenanted land in operated area falls as one passes from the marginal category to the large category. The percentage is 8.6% for marginal holdings, and it was as a whole under 6% for the rest of the holdings together.

- During the four decades from 1960-61 onwards, land tenure status of operational holdings has undergone significant changes. The proportion of tenant holdings declined sharply from around 24% to 10% during the period after 1970-71. This trend may indicate a continuous shift from tenant cultivation to self-cultivation which has been a characteristic feature of Indian agriculture during this period.
The extent of tenancy measured in terms of percentage share of operated area leased-in reveals a similar trend during 1970-71 to 1981-82. The share of leased-in land in operated area came down to 7.2% in 1981-82 from 10.6% in 1970-71. The 1991-92 survey estimated the share to have risen to 8.5%. However, the 59th round survey estimated it to be 6.5% which shows that the decline is continuing.

10.1.6 Terms of lease and size of holdings

Sharecropping is seen to be the most widely prevalent form of land lease in the three size classes spanning the range 0.04 to 2 hectares which accounts for more than 52% of the total leased-in area. ‘Fixed money’ contracts were the most common in the lowest range ‘below 0.04’ (accounting for less than 0.1% of total leased-in area) and in the range 2-10 hectares. If one leaves out the holdings of size below 0.04, the prevalence of fixed money contracts appears to increase more or less steadily with size of holding. Among the large holdings, however, the most common form of contract reported was ‘fixed money’ (36%). Leasing of land from relatives under no specific terms accounted for as much as 21% of leased-in area in the range ‘below 0.04’ but less than 8% in all other classes and only 4% for all holdings of all sizes considered together. However, the share of ‘fixed rent’ is rising in tenanted land.

10.2 Land holding pattern in Assam

The economy of Assam continues to be predominantly agrarian; the dependence of rural labour force on agriculture and allied activities was nearly 53 percent as per population census, 2001. In Assam, complete enumeration of the agricultural holdings was done for the first time under the programme of World Agricultural Census, 1970-71. Thereafter, Agricultural Censuses with reference year 1975-76, 1980-81, 1985-86, 1990-91, 1995-96, 2000-01 and 2005-06 were successfully conducted in the State.

10.2.1 Distribution of operational land holdings

The latest available data refer to the Agricultural Census, 2005-06 which reveals that there are 27.5 lakh operational holdings in Assam covering an area of 30.49 lakh hectares of land compared to 27.1 lakh operational holdings covering an area of about 31.1 lakh hectares of land in 2000-01.
As per the agricultural census, 2005-06, the marginal holdings accounted for 63.7 percent of the total holdings and 24.9 percent of the total operated area of the State in 2005-06. The small holdings shared 21.5% of the total holdings and 23.6 percent of the total operational area. On the other hand, the large holdings constituted only 0.18 percent of the total number of holdings and 9.8 percent of the total operated area in the state.

There is an increasing trend in the number of operational holdings from one census to the other. The increasing trend of number of operational holdings signifies the progressive fragmentation of operational holdings in the State from 1970-71 to 2005-06. It also indicates the intensity of population pressure on the area and the proliferation of nuclear families due to disintegration of the joint family system in the State.

The concentration of operational holdings highly dominates in the Marginal group (63.74%) while it shatters down to the lowest profile (0.18%) in the large group.

10.2.2 Distribution of area operated

It is found that there is also an increasing trend in operated area and this increasing trend continues till 1990-91 census. The percentage variation in the operated area under marginal size group is 14.69 which is the highest among the size group and indicates about the marginalization of land holding. In 1995-96, the operated area decreased by (-2.07) over 1990-91 census and (-0.79) percent over 1995-96 and (-2.09) percent over 2000-01.

The operated area holds the highest concentration (27.75%) in the semi-medium group while lowest (9.80%) in the large group according to 2005-06 census.

The most important indicator of fragmentation of land holdings is the average size of holdings which depicts a declining trend in the state since 1970-71 to 2005-06. A gradual decline in average size of operational holdings from 1.47 hectare in 1970-71 to 1.11 hectares within a period of three decades leads to small scale agricultural operation.
10.2.3 Land use pattern in Assam

- The total reporting area (as per village paper) of the State was 78.50 lakh hectares for the year 2008-09. Out of the total reporting area, net sown area constitute 35.80 percent (28.10 lakh hectares) as against 35.1 percent (27.53 lakh hectares) in 2007-08. 23.61 percent was under forest, land not available for cultivation is 33.45 percent (26.26 lakh hectares) as against 31.0 percent (24.35 lakh hectares) of the total reporting area for the year 2007-08 and other uncultivable area was 5.5 percent (4.32 lakh hectares). While fallow land constitutes 1.63 percent of the total reporting area with around 1.28 lakh reporting area with around 1.28 lakh hectares as against 2.4 percent (around 1.86 lakh hectares), land under still water and waterlogged area jointly constitutes 2.27 percent (1.78 lakh hectares). The area under social forestry was only 0.16 percent (0.13 lakh hectares) of the total reporting area.

- It is found that during the period of 1994-95 to 2007-08, total geographical area remains same. But permanent pastures and other grazing land, land under miscellaneous trees and groves and cultivable waste lands are decreasing gradually. Similarly area under forest, land put to non-agricultural uses, barren and uncultivable land, fallow land other than current fallow are decreasing but area under current fallow is increasing.

- The forest area covers 23.61 percent of the total geographical area which is decreasing gradually and less than the proportion of 33.3 percent to maintain the ecological balance.

10.3 Nature, extent and incidence of tenancy in Assam

- According to NSS data the percentage of leased-in area to total operated area was 19.69% in 1970-71, which has declined sharply to 6.35% in 1990-91. But the agriculture census data reveals somewhat different pictures on the extent of tenancy in Assam. In 1976-77, 3.18 percent land area in the total operated area was under tenancy and has increased to 3.8 percent in 1985-86 and remained stagnant even in 1990-91.

- The percentage distribution of leased out area over the specific terms of lease i.e. fixed money, for fixed produce, for share of produce and other terms (i.e. for
service contract, for share of produce together with other terms, under usufructuary mortgage, from relatives under no specific terms) shows that share of produce is the dominant terms of lease (38.71%) followed by fixed money term (20.47 %) as per the NSS Report No.491. Of course the ‘other term’ constitutes 40.82 % which is higher than the national level under the term.

- The percentage of household reporting leasing-out was 0.55%, while the percentage of households reporting leasing was 7.47 % in 2003 as per the NSS Report No. 491. The average area leased-in per reporting household is 0.43% and the leased-in area as percentage of total area owned is 5.81%. Thus there is a tendency to suppress information on leasing-out of land among the landowners owing to fear of tenancy legislation. This might have induced widespread under-reporting of leasing-out of land and thus the estimates of leased out land are generally underestimates.

- According to the estimate of agricultural census 2000-01, Assam, the share of produce is the dominating terms of lease and it is prevalent among the semi-medium holders. But in the three agricultural censuses i.e. 1976-77, 1985-86 and 1990-91, fixed money has been found to be the dominating mode of tenancy and there was a gradual increase in the area under usufructuray mortgage of land lease. This goes against the findings of NSS data which reveals that in spite of its continuously declining trends over the period 1971-72 to 1990-91, the share tenancy is still the predominant mode of tenancy in Assam.

**10.4 Agriculture in Assam**

Agriculture constitutes the major segment of the agrarian economy of Assam. Land for agricultural purpose, particularly for seasonal crops is the major constituent of land owned by the rural households. Agriculture sector continues to support more than 75 percent population of the State directly or indirectly providing employment of more than 53 percent of the workforce. Over the years i.e. from 2004-05 to 2010-11, the share of agriculture and allied sector in the GSDP has declined from 26% in 2004-05 to 23% by 2010-11. The contribution of agriculture sector to the total NSDP of Assam is 20.67% at constant price (2004-05).
The gross cropped area recorded a decrease to 38.39 lakh hectares in 2007-08 from 38.96 lakh hectares in 2004-05, while there is an increase from 38.39 lakh hectares in 2007-08 to 39.99 lakh hectares in 2008-09 but the net cropped area or net sown area remained at the same level i.e. 27.53 lakh hectares during the year 2007-08 as it was in 2004-05. But the area sown more than once and the net cropped area recorded an increase of 9.4 percent and 2.1 percent respectively with 11.88 lakh and 28.10 lakh hectares during the year 2008-09 over the figures of 2007-08. Thus, the cropping intensity in the State works out to be 139.45% and 142.31% for the years 2007-08 and 2008-09 respectively.

10.4.1 Cropping pattern in Assam

- The Gross Cropped Area in Assam for the year 2007-08 was 38.39 lakh hectares and area under tea cultivation was 3.21 lakh hectares in 2007. Excluding the area under tea cultivation the gross cropped area in Assam for 2007-08 comes to 31.18 lakh hectares. Of these, 23.24 lakh hectares i.e. 74.53% of the total were under Total Rice (i.e. Autumn Rice, Winter Rice and Summer Rice).
- The share of total food grains taken together (i.e. total rice, total cereals and total pulses) was 80.76% which means that wheat, maize, other cereals and small millets among themselves commands only 2.60% of the total cropped area.
- A striking feature of the cropping pattern of Assam is the predominance of paddy where the total rice area accounts for about 75 percent of the total crop area covered. The share of paddy during the period of 1990-91 to 2009-10 fluctuated between 70 and 75 percent without showing any distinct trend.
- The shares of pulses, potato, jute etc. have a rising trend. In contrast, there has been a steady decline in the share of wheat.
- There has been a gradual decline in respect of area covered for cultivation of Autumn Rice, which has switched over to the Summer Rice. This may be due to the higher productivity and hazard risk. The area covered under Winter Rice, the principal ‘kharif’ crop of the State had declined due to drought like situation experienced by the State during the year 2006-07.
For the State as a whole, there has been a significant increase in the share of summer paddy during the period of 1989-90 to 2009-10.

10.4.2 Growth rates of Area, Production and Productivity of Food grains, Non-food grains and All Crops.

During the sub-period of 1967-68 to 1980-81, the Annual Compound Growth Rates (ACGR) of Area, Production and Productivity of Non-food grains are 1.65, 5.03 and 2.99 percent respectively. Similarly, the ACGR of Area, Production and Productivity of Food grains are 1.73, 1.34 and -0.32 percent respectively, but the ACGR of Area, Production and Productivity of All crops are 1.71, 3.19 and 1.46 respectively which are significant.

During the sub-period of 1981-82 to 1990-91, the ACGRs of Area, Production and Productivity of Non-food grains were 1.51, 2.76 and 0.59 percent respectively which were significant but lower than that of the period of 1967-68 to 1980-81. The ACGR of Area, Production and Productivity of Food grains were 0.68, 2.22 and 0.73 percent which were positive. Here; the growth rate of production i.e. 2.22% is higher than that of the period of 1967-68, while the ACGR of Area, Production and Productivity of all crops were 0.89, 2.52 and 0.67 percent respectively which were positive and significant.

During the sub-period of 1991-92 to 2000-01, the ACGR of Area under Non-food grains was negative but insignificant.

During the entire period of 1980-81 to 2009-10, the ACGR of Area, Production and Productivity of Non-food grains were 0.07, 1.55 and 0.30 percent respectively where the growth rate of area was insignificant and other growth rates were positive and significant. Similarly, for Food grains, the ACGR of Area, Production and Productivity were 0.05, 1.62 and 1.20 percent respectively where the area growth rate was insignificant and for all crops, the ACGR of Production and Productivity were positive and significant but Area growth rate was insignificant.

Thus the Area growth rates for Food grains, Non-food grains and all Crops were insignificant and deceleration was observed for the same during 1980-81 to 2009-10.
During the sub-period of 1967-68 to 1980-81, the ACGR of production and productivity of Non-food grains were higher than that of Food grains.

During the sub-period of 1981-82 to 1990-91, the growth rates of Area and Production of Non-food grains were higher than that of Food grains.

But during the sub-period 1991-92 to 2000-01, the growth rate of productivity of Food grains was higher than that of Non-food grains.

For the entire period of 1980-81 to 2009-10, the growth rates of production and productivity of Food grains are higher than that of the Non-food grains.

Growth rate of productivity of Food grains shows an increase from 0.73% per annum during the period of 1981-82 to 1990-91 to 1.38% during the period of 1981-82 to 1994-95, but it is 0.85% during the period of 1995-96 to 2009-10 which remained well below 1% per annum.

Production of Non-food grains seems to have declined from 2.76% per annum during the period of 1981-82 to 1990-91 to 2.63% per annum during the period of 1981-82 to 1994-95.

There is notable deceleration in the rates of growth of agricultural production during the period of 1980-81 to 2009-10. Before that, growth in area continued to be the main source of agricultural growth in Assam even during the 1970s and early 1980s.

10.4.3 Agricultural productivity and yield gap of crops in Assam

Barring one or two crops, the crop yield per hectare in Assam has been much lower than the all India yield rates in recent years. The yield differences show fluctuations from year to year. But underlying such year to year fluctuations, a tendency of widening of the yield gap over the years is visible in the case of two grains included in the study i.e. Rice and Wheat.

In case of Rape and Mustard, the highest gap is pronounced in 2009-10 i.e. 55.25% and it is 44.74 % for sugarcane in the year 2001-02.

The highest yield gap for rice is pronounced in the year 2006-07 which is 35.76% and it is 62.50% for Wheat in the year of 2008-09.
10.4.4 Growth performance of the principal crops, food grains, non-food grains and all crops.

- The Annual Compound Growth Rate (ACGR) of total rice in Assam from 1980-81 to 2009-10 (with triennium ending 1981-82=100 as the base) was 0.18% (significant at 10% level of significance) and that of production and productivity growth was 1.72% and 1.23% respectively.
- The ACGR of area, production and productivity of Summer Rice was very high i.e.10.53%, 12.77 and 2.66% respectively for the period 1980-81 to 2009-10. This high growth rate of Summer Rice is an important feature of the growth pattern of rice in Assam resulting from fast increase of area and yield of the crop, but there is a significant negative growth of production of Autumn Rice.
- In Assam, deceleration is observed in case of area, production and yield for the food grains, non-food grains and all crops for the period of 1980-81 to 2009-10, where the compound growth rate of production and productivity of food grains is higher than that of non-food grains, but ACGR of area of non-food grains is higher than that of food grains for the same period.
- In the first phase of Green Revolution (i.e. during the period of 1967-68 to 1980-81), the ACGR of production and productivity of non-food grains was higher than that of food grains and there was negative growth of productivity of food grains during the period.
- During the period of 1981-82 to 1990-91, ACGR of production and productivity of food grains has increased but the area growth rate decreased. On the contrary, during the same period, the ACGR of area, production and productivity of non-food grains has decreased considerably and starts deceleration.
- Potato being an important vegetable of Assam constitutes a significant growth in both production and productivity. During the period of 1980-81 to 2009-10, the estimated ACGR of production and productivity of potato is 3.53% and 1.00% respectively, while the area growth rate is 2.37% which is also significant.
The area under wheat in Assam is more than 2% of the area covered by all crops but during the period of 1980-81 to 2009-10, ACGR of area, production is negative and insignificant.

Sugarcane covering an area of 1.14% of total area under all crops shows negative growth of area, production and productivity.

Jute almost covers 2% of the total area covered by all crops. During the period of 1980-81 to 2009-10, the growth rate of area and production is (-2.45%) and (-1.89%) respectively, though the growth rate of productivity is positive.

Thus the overall growth pattern, however, conceals a great deal of temporal variations in different sub-periods. The eighties as a decade was substantially better than nineties in terms of the growth performance of food grains.

10.4.5 Technological changes in the agricultural operations in Assam

The area under HYV of rice in Assam has increased steadily during the period of 1981-82 to 2010-11 where the percentage of area under HYV in total rice acreage of the State is going up from 37.1 percent in 1981-82 to 67.26 percent in 2010-11, but the spread of HYV of rice in Assam has been slower than their spread in the country as a whole.

In spite of the steady increase in the area under HYVs of rice in Assam, the ACGR of rice yield per hectare in the State works out to be only 1.52% for the period 1980-81 to 2009-10. Thus HYVs seem to have contributed very little towards improving productivity of rice in the State during the period.

By 1984-85, over 55% of the total rice acreage of whole of India was brought under HYVs, but it was 40.9% in Assam in 1984-85. Similarly, by 1994-95, about 73% of total rice acreage was brought under HYVs in the country as a whole, but in Assam it is 44.90% only.

The trend of fertilizer consumption in terms of nutrients (N+P+K) per hectare in the State is much lower than the national average consumption. Generally, the consumption of chemical fertiliser is lower during the kharif season than that of Rabi season.
Fertiliser consumption per hectare in Assam has been going on more or less steadily from the middle of 1970s. But, comparatively, the level of fertiliser consumption per hectare in the State continues to be very low. In view of such low level of fertiliser consumption in Assam, the relatively low yield rate of crops in the State compared to the all-India average yields of respective crops are not very surprising.

The physical progress of irrigation work in the State can be better understood if net sown area is also considered along with net irrigated area. In 1997-98, net irrigated area in Assam was about 20.79 percent of the net sown area as against the national average of 38.42 percent.

It is found that the irrigation potential created under minor schemes has been more than that of under major or medium schemes. For example, in 2005-06, as against a share of 40.08 percent under major or medium schemes, share of minor schemes in total potential created was 59.91 percent.

In 1980-81 about 90.59 percent of total utilisation was for ‘Kharif’ crops while for Rabi and pre-kharif, it was as meagre as 9.41 percent. The situation has not changed much over the years. In 1995-96, out of a total utilisation, ‘Kharif’ crops alone accounted for 84.85 percent leaving 15.15 percent Rabi and pre-kharif crops. Thus for the whole period not much diversification of crops has taken place.

Utilisation of irrigation potential as percentage of potential created in the State is also not very high. It is not only low but is also decreasing over the years.

Estimated utilisation ratio is also not very high confirming that utilisation of created irrigation potential under government irrigation schemes is not satisfactory.

Thus, though there is an increase in irrigation facilities in the State since the 1990s, irrigation ratio in the State has remained below 5 percent indicating thereby that irrigation has so far played only marginal role in the agriculture of Assam and has been decreasing from 5.47% in 1992-93 to 1.56% in 2004-05 and it is 4.11 in 2009-10. But in India as whole, it is 38.91% and 46.84% respectively in 2000-01, 2005-06.
10.5 Findings from field study

- **Marginalisation and inequality in the land holding pattern** - The distribution of the sample farms according to the size group in both ownership and operational holdings reveals that marginal farmers constitute the majority among the farm households, which is 37% of sample farmers with 9.84% of the total area owned while 45% of the sample farmers had operational holdings of size below two hectares. Thus, small scale agricultural operation along with the marginalisation of land holding is the main characteristic feature of agrarian land holding across farm households of the sample area. Moreover the average size of operational holdings of the sample farmers was 2.68 hectare which is marginally above the same for the State as a whole.

- **Incidence of tenancy** - Tenancy has been found to be fairly extensive among sample farmers and about 61% of sample farmers had land on lease as part of their operational holdings. Total area leased-in constituted 23.73 percent of total operational holding among the sample farms. The tenancy was generally temporary, usually for one to three or four years and also completely informal in the form of share cropping mostly without sharing of cost. About 52% percent of sample farmers take their leased-in land on the terms of share cropping which is dominant here followed by fixed rent tenancy. Terms of leasing for service contract are not observed among the sample farmers. Moreover, from the distribution of type of households, it is observed that majority of the households are from owner-cum-cultivating tenant which constitutes 52% of the farm households.

- **Irrigation facilities in the sample farms** - The irrigation facilities are not so much poor in the sample area, this is of course due to the pre-condition in the selection of sample villages that there must have reasonably developed irrigation infrastructure at least in one of the selected villages in each of the circles. However, 70% of the sample farmers had irrigation facility and area with irrigation comprised merely 42.26 percent of the combined gross cultivated area of the sample farmers. Sample farmers having irrigation facilities are mostly from semi-medium group (44%) with 43.40% of the total irrigated area followed by the small group commanding 29% of sample farmers with 19.0% of total irrigated area. 79% of the total irrigation facilities was utilised for
growing high yielding autumn or Ahu and Boro paddy and the remaining 21% was utilised for cultivation of vegetables in the dry season.

- **Adoption and Uses of high yielding varieties of seeds** - A large majority of farmers have been found to be using these HYVs of seeds. About 78% of all sample farmers have so far tried these varieties at one time or the other. Thus, the adoption of HYVs is almost universal. But, despite adoption of HYVs by a large majority of sample farmers, the spread in the area under these varieties has been found to have remained fairly limited. It is found that 23% of sample farmers were induced by extension workers to adopt HYVs and the rest adopted seeing fellow farmers.

- **Uses of chemical fertiliser (soil nutrients)** - As in the case of HYVs, the adoption of chemical fertiliser was almost universal among sample farmers. It was found that farmers used fertiliser at a higher dose on crops such as vegetables and Rape & Mustard rather than on their main crop, that is paddy. The overall fertiliser consumption rate i.e. 70.07 Kg per hectare is higher than that of the State level. Altogether, 68% of all sample farmers have been found to be using chemical fertilisers. In general, the uses of chemical fertiliser seem to have gone along with the adoption of HYV seeds. This tendency is generally promoted as a package rather than as two separate practices.

- **Mechanisation in agricultural practices** - The sample data shows that the adoption of mechanised ploughing is far less extensive than that of HYVs and fertilisers. Though 60% of sample farmers resorted to mechanised ploughing only in case of 50 numbers of farmers of them, ploughing was entirely mechanised, the remaining 82 farmers actually used a combination of mechanised and manual ploughing.

- **Extension service network** - On the whole, the sample survey shows that the extension service in the sample area is very poor. In the earlier system of contact with farmers, the VLEWs were to disseminate information by contacting one out of every ten contiguous farmer. In the new alternative, the farmers are being encouraged to form FMCs involving all the farmers of a particular field and the VLEWs are expected to cater to all these farmers through the FMCs. However, as the field survey reveals, a
large section of farmers are still bypassed by the extension agencies in spite of the changes in the service delivery system.

- **Factors affecting agricultural productivity (yield of rice)**—The yield of rice per hectare has been recorded to have varied from 1019.50 Kg to 2898.12Kg per hectare. This variation has been explained with the semi-logarithmic multiple regression model. The variation in the yields across the sample farmers of the ADO circles corresponds more to the rate of fertiliser consumption per hectare and to the proportion of HYV area in the total rice acreage. Fertiliser consumption was highest in Dhekorgorha circle and then Jaluguti circle, so the yield rate of rice may be higher. Here, fertiliser consumption rate is more important than that of HYV seeds. Thus, the new technology in the form of HYV seed-fertiliser-water package has been found to be more fruitful in raising productivity. This effect is the same on agricultural production as that of an increase in the total land resources. So, this land augmenting character of the new technology is more appropriate for the existing agrarian structure in Assam.

The association between the yield of rice crop and the factors such as—proportion of irrigated area under total rice acreage, the proportion of HYV rice area in the total rice acreage, the adoption of mechanisation in the farm practices, fertiliser consumption, and educational standard of the farm family have been found to be positive and significant. Similarly, the factors such as the size of the farm household, tenancy i.e. the percentage of leased area in the total rice acreage, the size of the operational holdings have positive and insignificant impact on the yield of rice. Hence, it can be inferred that farmers with larger farm size tended to have higher rate of yield of rice per hectare. Similarly, the household size and tenancy had no significant impact on the yield of rice. Thus the technological factors as said above are more influencing than the other agrarian factors. Moreover, the relation between the yield of rice and the contact with the agricultural extension service network has been found to be negative but not significant. The benefit as received by the farmers from the agricultural extension service has not been able to contribute towards the increase in the yield of crop which implies very poor state of the agriculture extension service in the sample area.
Cropping pattern and the factors affecting cropping intensity—Among the sample farms, about 81% of the combined total cropped areas of the 220 sample farmers were under rice. The cropping intensity has been found to vary from 146.36% to 184.42%. The factors which were found to be significantly associated with the adoption of multiple or double cropping by farmers are—the size of operational holdings, proportion of irrigated area in total cropped area, percentage of leased-in area in the total operational holdings. The relation between farm size and cropping intensity is negative and highly significant implying that cropping intensity tends to be higher for smaller farms. Farmers with smaller size of operational holding use land with greater intensity than a farmer with large operational holdings. The proportion of irrigated area in total cropped area has been found to be positive and significantly associated with cropping intensity. Obviously, the availability of irrigation facilities in the cropping area tends to increase the cropping intensity even in the dry season. It can be rationalised on the reason that the water control and flexibility of irrigation facilities can give the farmer enough freedom for multiple cropping. The proportion of area under HYV in gross cropped area and farmers contact with agricultural extension service network are positively and significantly associated with cropping intensity. The support of extension service tends to encourage the farmers to go for multiple cropping through their effective interaction with the farmers. The percentage of leased-in area in the total operational holdings has been found to have negative and significant relation with the cropping intensity which indicates that tenant farmers are less inclined towards multiple cropping. Thus, it can be inferred that ownership can give enough freedom to the farmers to go for multiple cropping. The cropping intensity is higher for the smaller size of the household than their counterparts of large size of household. The adoption of mechanisation process may not encourage the farmers to go for multiple cropping. Farmers in dry season may go for vegetables cultivation or for the Rabi cultivation where they may not be able to adopt mechanisation in the farming practices.
10.6 Conclusion

The study clearly demonstrates that the technological factors are relatively more influential and found to be conducive towards achieving higher agricultural productivity in terms of crop yield per hectare of cropped area within the existing agrarian structure and relations in Assam. The application of the HYV seed-fertiliser-water package has been found to be more effective and fruitful than the effect of the other agrarian factors. The study has shown that crop productivity is positively and significantly associated with the proportion of irrigated area, proportion of HYV rice area in total rice acreage, adoption of mechanisation in the farm practices, fertiliser consumption and educational standard of the farm households etc. Thus, the HYV seed-fertiliser-water package has the same effect on agricultural productivity as that of an increase in the total land resources. This land augmenting character of the new agricultural technology is more appropriate for the existing agrarian structure in Assam. But the factors such as size of the farm household, tenancy and size of the operational holdings have positive impact on the productivity but are not significant. Hence the farm size has little to do with the variation of yield of crop or productivity. Still it can be inferred that farmers with large holding size tended to have higher rates of yield per hectare. Thus the inverse size-productivity issue is not valid here and tenancy and house size have no significant impact on the agricultural productivity.

The overall agricultural productivity in the State has not improved very much despite the adoption of HYVs by the sample farmers here because these varieties have been found to have remained fairly limited. Despite wide spread adoption of HYVs, the proportion of HYV rice area in gross crop area was limited to 28.79% only. Here, it is to be mentioned that only 23% of the sample farmers were induced by the extension workers to adopt the HYVs and the rest adopted by seeing the fellow farmers. However, the fact is that farmers adopting these varieties in general have not been able to use very extensively and effectively owing to a number of constraints operating upon them.

The findings of the study mainly point to the following factors as principal deterrents for achieving higher productivity. They are-
Limited availability of irrigation facilities, low effectiveness of the present system of agricultural extension service, low level of fertiliser consumption, limited spread of areas under the new rice varieties (HYVs), some new rice varieties are of limited suitability in the environmental condition of the main rice growing season of the State, limited role of tenancy and the size of the farm households, sub-division and fragmentation of operational land holdings along with the declining trend in the average size of holdings etc.

Due to heavy monsoon rains during the first half of the main rice growing season (i.e. from July to September), it is common in many parts of the State that paddy fields get water-logged and flooded. Improved rice varieties which can withstand such conditions are yet to be involved by agricultural scientists. Thus, farmers can extend the cultivation of high yielding rice varieties in the main rice growing season, only to those areas which are free from such problems.

The field study has clearly shown the importance of irrigation as a significant factor influencing positively the yield of crop and cropping intensity. Though the irrigation facilities are increasing in the State since 1990s, it is found that, irrigation ratio in the State has remained below 5 percent indicating thereby that irrigation has so far played only marginal role in the agriculture in Assam. Ironically, a substantial part of the meagre irrigation facility of the State has remained unutilised. Inadequate planning and lack of co-operation among various agencies are responsible for implementation of irrigation programme. The meagre amount of irrigation facilities available in the State has thus impaired the wider adoption of the new farm technology in Assam at least in two ways. First, it has restricted farmers’ ability to extend the use of HYV seeds particularly in the dry season. Secondly, having to cultivate HYVs mostly under unirrigated conditions, farmers in general have not been able to utilise effectively the potentialities of these varieties as well as of the land potentiality by adequate application of soil nutrients with them. Absence of irrigation has not allowed for diversification of crops from the predominance of winter rice to less floods affected and dry season summer and autumn rice.
It is worth mentioning that in recent years, growth in production and yield of rice has come in other parts of the State and the country primarily from growth in area and productivity of high yielding summer rice grown under irrigated conditions. Moreover, in spite of the limited availability of irrigation cover for farmers, it has been observed from the field study that when such cover is available, farmers tend to use fertiliser at a higher dose and are also inclined to adopt other modern practices, such as mechanised ploughing etc. The fact that non-availability of irrigation is one of the most frequently cited reasons by sample farmers for not using the HYV seed-fertiliser technology more extensively also goes to support the contention that the virtual non-existence of irrigation cover is a major constraint for agricultural development in the State.

Fertiliser consumption has the positive and significant impact on the yield of crop or productivity as shown by the field study. To get better result out of the HYVs, the soil is to be supplied with additional nutrients through the application of chemical fertilisers to it. But its consumption per hectare of cropped area in the State has in fact been found to be lowest in the country and the trend of fertiliser consumption in the State in terms of nutrients (N+P+K) per hectare is much lower than the national average. The reason behind the lesser consumption is that the farmers are reluctant to use fertilisers during ‘kharif’ season fearing monetary loss due to heavy rainfall and flood. Of course, farmers used fertiliser at a higher dose on crops such as vegetables and Rape and Mustard rather than on their main crop i.e. paddy.

The field study shows that the extension service in the sample area is very poor. Only about 23% of the sample farmers have been found to be in such beneficial contact with extension agencies. A large section of the farmers are still bypassed by the extension agencies in spite of the changes in the service delivery system. Clearly, the inadequate quantity and quality of the extension service have deprived many a farmers from the necessary guidance for successful adoption and effective uses of better farm practices. The field study has established the fact that agricultural extension service is the most powerful of the various media for carrying agricultural innovations to farmers’ fields. But unfortunately, as the findings of the field study
indicate, agriculture extension service network in Assam so far has not been able to build up effective contacts with a large section of the farming community in the State. The loopholes in the agricultural extension service must have contributed towards restricting the pace of transfer of technology to the farmers’ field in Assam.

In case of tenancy, it is found that the percentage of the households leasing in land is very high (61%) and the percentage of area leased-in to the total operational holdings is (23.73%). Tenancy is almost universal among the sample farmers where 52% is owner-cum-cultivating tenants and only 9% is pure tenant. But the leasing out record is very less which implies underreporting or unrecorded lease which may be due to the fearing of tenancy legislation. Moreover, tenancy has been found to have negative and significant impact on the cropping intensity. Thus self cultivation is the trend which may be uprising to get rid of exploitation of rack renting. Thus tenancy is one of the major constraints towards adoption and uses of improved agricultural practices by the farmers. They are in disadvantage in extending their area under HYVs, application of fertilisers in adequate quantity, adoption of mechanised ploughing and also in increasing their cropping intensity. Thus among institutional factors, tenurial arrangement in practice has been found to be restricting the effective use of available technology package by the farmers.

The average size of the operational holdings is gradually decreasing in the State of Assam. But the field study shows that the size of the operational holdings has positive and significant impact on the yield of rice. Thus the decreasing size of holding is restricting the internal economies as availed by the large size of operational holding through the application of modern agricultural inputs and mechanisation in the farm practices. Moreover, subdivision and fragmentation of operational holdings is also restricting the same for achieving higher productivity.

Thus, the field study provides empirical evidence that technological factors are more influential in raising crop productivity as compared to the agrarian factors. However, this exercise identifies the poor state of agricultural infrastructure, especially of irrigation, extension service and limited suitability of available technology package to a good part of cultivated area and existing tenurial arrangement in practice as the
constraints on agricultural development in the State. Still, considering the positive and significant impact of these technological factors on the yield of rice, it can be inferred that existing agrarian structure and relations are technologically conducive to achieving higher agricultural productivity and growth through the realisation of potentiality of land resources in terms of crop productivity per unit area.

10.7 Suggestions

Each existing agrarian structure appears as the result of a continuous process of adaptation of man, land and technology in ever changing combinations of factors and relationships. Thus, the policy suggestions for making the existing agrarian structure more conducive towards achieving higher agricultural productivity and thereby agricultural development of Assam, can be derived on the basis of the findings of the present study, and are summed up in the following paragraphs.

The conclusion of the study suggests that to make the existing agrarian structure more conducive to achieving higher agricultural productivity and growth through the realisation of potentiality of land resources in terms of the crop productivity per unit area, measures would be necessary in two directions, namely-

i) The agrarian reforms through the institutional changes in the distribution of ownership and operational land holdings and the land tenure system.

ii) Development of agricultural infrastructures for enabling the farmers to utilise the potentials of the existing land resources and crop varieties with the help of modern agricultural inputs and practices to get maximum possible output.

It is necessary to strengthen the agricultural infrastructure both qualitatively and quantitatively. In particular, it would be necessary to improve irrigation facilities, agricultural extension service and the flow of institutional credit to the farm sector.

Irrigation is the main input to the agricultural practices. To coping with the growing problem of food shortage due to formidable increase in population and adverse and unpredictable weather condition, natural calamities etc., multiple cropping, modernisation of agricultural practices is highly essential in the State of Assam. For a sustainable development in the agriculture sector, availability of assured irrigation facility is undoubtedly the most important prerequisite. Thus, the importance
of irrigation development bears special significance in the context of efforts towards economic development of the State. So, the steps for development of irrigation infrastructure are urgently needed. Programmes for development of irrigation facility may be taken up under two broad heads viz. Major & Medium Irrigation and Minor Irrigation. For developing irrigation infrastructure, the department has to depend on its river systems for water source as well as the ground water. The emphasis under the programme should be on minor irrigation system based on deep and shallow tube wells, which can be quite effective for exploiting ground water reserve for irrigation.

Improvement of irrigation facilities in the State is a matter not merely of creating additional irrigation potentials but also of ensuring that the potential created is fully utilised. Available statistics and literature on the subject enables us merely to suggest that as far as practicable, in the future plans for development of irrigation potentials in the State, emphasis should be given more on ground water based well irrigation systems than on major or medium surface flow systems based on dams across rivers. Since the average size of operational holdings is gradually decreasing and comparatively smaller than in most of other States of India. So, ground water based well irrigation systems are suitable which are cheap and also within easy reach of an average farmer. The small scale nature of shallow tube well based irrigation system is ideal for most farms in Assam.

Geological surveys have found that there is tremendous scope for developing ground water based irrigation system in most parts of the State except the Barak Valley. “Assam is comprised of three hydro-geologic units, viz. the Brahmaputtra Valley, the Central Assam Range (Karbianglong and North Cachar Hills Districts) and the Barak Valley”. (Das, 1984).Thus the entire Brahmaputtra Valley can be considered as a vast reservoir of ground water. The water table is generally within five metres below the land surface except in a narrow belt of 10 to 15 kilometres of width in the northern side running along the foothills of the Himalayas. In this belt, water table generally lies at a depth of 15 to 35 metre below the surface. Development of irrigation from ground water through shallow and deep tube wells is feasible in the entire Brahmaputtra Valley. Apart from the usual problems of large initial investment, long gestation period
and the necessity to construct elaborate network of distributor field channels, surface flow irrigation systems based on river dams have several limitations in Assam. First, due to highly permeable character of the solid in most parts of the State, the loss due to seepage in the process of distribution may be very substantial. Secondly, maintenance of the distributor channels during the rainy seasons and also keeping them clear from aquatic weeds may become a serious problem. In fact, the possibility of such irrigation systems aggravating the problems of floods and water logging in the State during the rainy season cannot be ruled out. Well irrigation, on the other hand, has been found to be generally superior to canal irrigation in a number of studies in India. However, large scale development of ground water based irrigation systems may lead in the future to new problems related to lowering of the water table. Hence irrigation development schemes must be prepared and executed cautiously with an eye towards conservation and replenishment of the natural water resources of the State (Bezbaruah, 1994).

Raising of crop productivity and cropping intensity are the both important measures for increasing agricultural production considering the food security of the country. Hence, cropping intensity or multiple cropping is more essential. Field survey shows that tenancy has negative and significant impact on cropping intensity. Thus the tenurial set-up in practice has been identified as a constraint on the agricultural development for which tenancy reforms may be called for to waive the same. Incidentally, legislations for tenancy reforms are already in existence for quite some time. For instance, The Assam Adhiar Protection and Regulation Act, 1984 seems to have enough provisions to protect the interest of the sharecroppers by fixing the maximum rent paid by them. Share croppers are required, according to the provisions of this Act, to share their principal crop only, which should provide some incentive to them to raise additional crop too. Ejecting adhiars was also made more difficult (Goswami, 1986). But despite the provision of the Act, sharecropping is still practised largely and informally. Though tenancy reforms have been recognised as one of the principal goals in the five year plan documents, only a few States in the country have successfully implemented such reforms. Thus to safeguard the tenant farmers interest,
in sharing of crop along with cost of production with landowner, a land reform programme should be taken up so that the provisions of the legislations aimed at protecting the interest of the tenant farmers are enforced in true sense of the term.

The farm size i.e. the size of the operational holdings has been found to have negative and significant impact on cropping intensity but it has positive impact on the crop productivity. Since the HYV seed-fertiliser-technology and its effect on raising crop productivity has been found to be appropriate in the sample area which have the same effect on agricultural production as that of an increase in the land resources. This land-augmenting character of the new technology is very appropriate for the agrarian structure in Assam. Moreover, marginalisation along with the gradual declining trend in the average size of operational holdings is going on. In that context, small size of operational holding should not be considered as a constraint for the use of HYV seed-fertiliser-technology. Of course, it has been observed that with the increase in holding size, farms tend to enjoy internal economies reflected in lower operational expenditure per hectare of gross cropped area. This finding makes a case for measures for consolidation of holdings. The Assam Consolidation of Holding Act, 1960 provides for consolidation and prevention of fragmentation of agricultural holdings below 5 ‘bighas’ of land for ensuring better cultivation (Goswami, 1986). But as in the case of the tenancy legislation, this piece of legislation has also remained unimplemented till date. Hence, a programme for effective implementation is, therefore, required in this case.

In spite of re-orientation of government extension service network over the last decades, there are still many gaps in the coverage of extension agencies in the State of Assam. The problem of adequate coverage and intensity of the extension service, therefore, needs to be addressed for expediting the transmission of agricultural innovations to the farmers. Thus, it would be necessary to strengthen the agricultural extension service in the State so that a more efficient and effective extension service is catered directly to a wider section of farmers. Experiences in the field survey indicate that the existing system of communicating information from the VLEW to the farming community through the selected groups of contact farmers, has not worked
satisfactorily. Technically, there is no guarantee in the system that information conveyed by VLEW to contact farmers gets communicated to all farmers in the locality. Increasing the number of VLEWs in each circle and at the same time raising the number of contact farmers in each VLEW ‘eleka’ or area may help to cover the loopholes in the extension service network to some extent. When the number of contact farmers increases it would bring more farmers to direct contact with the extension service network. It would further increase the number of VLEWs to make the service more intensive. For the sake of the quality of the extension service, it is imperative to ensure that a VLEW is assigned the responsibility of an area only after being adequately trained and properly qualified. The present working conditions of the extension workers and the development officers, of course, cannot be said to be quite conducive for highly efficient and effective discharge of their duties. A development officer, for example, is denied the facilities of a small office establishment and a proper place for keeping inputs received for demonstration plots for qualitative improvement of the extension service. It is necessary to improve the working conditions of the people in the service and at the administrative level; the extension service needs to be streamlined by making its personnel accountable for the better performance of agriculture in their respective areas. Field Management Committees should be formed at the instance of personnel of extension agencies rather than on farmers own initiative. While better coordination and cooperation among farmers are important, conditions should be created for self-organisation of farmers on their own initiative.

Farm mechanisation is a critical input as it facilitates timely agricultural operation. Though the mechanisation has been found to have positive and significant impact on crop productivity in Assam, the growth of mechanisation is slow and not spreading among the farmers. The low availability of farm power has become constraint for double or multiple cropping in the State. In order to boost up farm mechanisation, special thrust should be given by the State Agriculture Department in schematic manner. At present, the availability of farm power in the State is only 0.90HP per hectare as compared to 1.40HP per hectare at national level (Government of Assam, 2011-12).
The problem of flood and erosion is menacing and the most acute and unique in the country. Every year successive waves of floods submerges most of the areas for a considerable number of days causing wide spread damage to crops, public and private properties, disruption of vital communication link within the State, with neighbouring States and also with the rest of country. This phenomenon takes place because of the occasional failure of the already existing flood prevention structure, which have outlived their lives. In order to combat flood problems, existing embankment system should be strengthened, new embankment is to be raised to bring more areas as under benefitted area. Anti-erosion and protection works of valuable fertile lands, removable of drainage congestion are also important measures to be taken up by Water Resource Department through the proper utilisation of funds as released time to time by the Govt of India and Assam.

Keeping in view the limitations of the known HYVs to the water-logged and flood-prone areas of the State, research efforts need to be concentrated on development of new breeds which can thrive well in such conditions besides giving reasonably high yields. So, the co-ordinated research in various branches of agricultural science is necessary for improving the existing package of new farm technology. Moreover, agricultural research cannot ignore the broader questions of food safety, ecological balance and environmental cleanliness which are reported to have endangered by the high ‘inorganic fertiliser and toxic pesticides’ intensiveness of the HYV seed based technology. So, Agricultural scientists in this part of the world are also expected to keep up with the latest global trends in research for evolution of new crop varieties less dependent on agrochemicals.

As per the conclusion of the study, the services and functionaries of the institutional credit system in the sample area leaves much to be desired. However, the measures for making the credit delivery system more effective and instrumental in ushering in rapid agricultural development of the area could not be suggested on the basis of the present study. It needs separate studies with special focus on the credit delivery system.