CHAPTER XI

FACTORS OF AGRICULTURAL PRODUCTION

Economic structure of agriculture is mainly based on (i) the factors of production, viz. land, labour, capital, organisation, and technology; and (ii) the infrastructure comprising mainly rural electrification, irrigation, agricultural credit, transport and market. In a laissez faire market economy, small peasants are vulnerable to economic inequality generated by the capitalist organisation of the capitalist farmers and the bureaucratic-elite nexus. In order to avoid the onslaught of capitalism, the only alternative is the co-operative or collective farming, not the creation of a bi-modal type of agriculture with small peasant proprietorship on the one hand, and capitalist farmers on the other, as has been attempted by the Government in India through its various agricultural policies.

The main weakness of agricultural planning in India has been that everything is talked about in terms of targets, though the final decision lies with the peasants, and not with the district and block agricultural officers and extension workers. But the peasants are not capable of making full use of the facilities offered by the Government for increased production. Solution lies not in the Government's existing efforts to effect
agricultural development for they are as much external to the peasantry. The crux of the problem lies in transforming the peasant mode so that a peasant may become a farmer in the real sense.

11.1 LAND

Land is one of the familiar triad of the factors of production — land, labour and capital. Regarding the role of land in agricultural growth and development, a variety of conflicting views exists. It is no longer deemed to be a critical limiting factor in economic progress that it was once, as propounded by Ricardo who assigned a major role to agricultural land. But R.F. Harrod, in selecting the economic variables for his 'Dynamic Economics', saw fit to leave out land altogether.

In technically advanced countries, the economy has freed itself from the severe restrictions formerly imposed by land. Such achievement is the result of new and better production possibilities brought about by science and technology. But in a technically backward community or 'a high-food-drain' community (where more than 75 per cent of the income is used for food)


2 Schults, T.W., ibid, p. 126

as in Assam, it is hard to comprehend the declining economic importance of land and the freedom from the niggardly grip of Nature. The Ricardian model of economic growth based on the law of diminishing returns still holds good in case of peasant agriculture in Assam. There is, however, no reason to be pessimistic for the operation of the Ricardian law, since the people will be able to make technological improvement to counteract the effects of diminishing returns, both by raising farm yields and by making international and intranational movements of agricultural produce a reality. But the crux of the problem here is how to usher in technological revolution in a self-subsisting peasant community with a myriad of fragmented holdings where most of the property consists of land and most of the political power and social privileges are vested in those who own large land holdings. Thus the relation of land to economic development is a many-sided matter, since land itself has a variety of aspects, both physical and economic.

The productivity of land in agriculture measured in terms of output per hectare varies greatly. Soil differs widely in their productivity owing to physical and chemical properties as also accessibility both to markets and inputs. Where the abundant but infertile land is inhabited by poor people lacking


capital and advanced techniques, the land/population ratio is likely to reach the Malthusian limit with increase of population. But the productivity of such land, if inhabited by resourceful people, may be increased by the application of modern technological inputs, and the Malthusian limit of land/population ratio may be obviated. It is seen, therefore, that the productivity of land is a function not only of its physical characteristics, climatic setting, and the availability of other factors, but is closely related to technology. The capacity of land to support increased number of people or the same number at higher level of living, has grown continuously through history as technological development increases the productivity of land.

The economic importance of land in Assam can be gauged from the fact that it accounts for as high as 91 per cent of the value of total operational assets of the farms followed by 4 per cent in draught animals, 3 per cent in farm buildings, and only 1 per cent in implements and machinery. In Punjab, agriculturally one of the most prosperous states in India, land accounts for 87 per cent followed by 4 per cent in farm buildings, 4 per cent in implements and machinery, and 1 per cent in draught animals.

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6 P.M.S. Howgong District, op. cit., p. 64
7 Studies in the Economics of Farm Management in Ferozepur District (Punjab), Report for the year 1969-70, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, p. 42
In a progressive and productive agriculture, the share of land decreases, while that of other forms of capital increases. Assam, however, does not show the increased importance of other forms of capital excluding land. The relative importance of draught animals is also another index of backwardness of peasant agriculture in Assam. Because it hints that farms are not mechanised. Table 11.1 shows that the proportion of investment on land steadily increases from the lower size-groups to higher size-groups, but the investment in other forms of capital decreases from lower size groups to higher size-groups. Such a situation, however, should not be understood to indicate that the small-sized holdings are more progressive than the big-sized ones on the plea that the share of land decreases in small holdings. This paradox can be explained by the fact that the small peasants do not possess sufficient land in proportion to other capital inputs possessed by them. But the big peasants possess sufficient land in relation to their capital inputs. It is now evident that the amount of land possessed and operated by a cultivator decides his fortune. If a peasant does not possess land for agricultural operation, he becomes pauper. On the other hand, if another peasant possesses operational land, however small may it be, accrues some benefits, even if he does not work on it. Thus the predominant role of mere physical land is seen only where there is social injustice and economic irrationality.
Table 11.1
PROPORTION OF INVESTMENT OF DIFFERENT ASSETS BY FARM SIZE-GROUPS (1968-69)

<table>
<thead>
<tr>
<th>Farm size-group (hectare)</th>
<th>Self-cultivated land</th>
<th>Farm buildings &amp; Machineries</th>
<th>Implements &amp; Machineries</th>
<th>Drought animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 - 1.82</td>
<td>88.55</td>
<td>4.04</td>
<td>1.19</td>
<td>4.38</td>
</tr>
<tr>
<td>1.83 - 2.43</td>
<td>88.60</td>
<td>4.18</td>
<td>1.08</td>
<td>3.39</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>90.47</td>
<td>3.01</td>
<td>0.90</td>
<td>3.92</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>91.42</td>
<td>3.13</td>
<td>0.81</td>
<td>3.33</td>
</tr>
<tr>
<td>Above 4.45</td>
<td>93.37</td>
<td>1.88</td>
<td>0.56</td>
<td>3.13</td>
</tr>
<tr>
<td>All farms</td>
<td>91.20</td>
<td>2.94</td>
<td>0.82</td>
<td>3.57</td>
</tr>
</tbody>
</table>

(Source - F.M.S. Nongpok District, op. cit., p. 67)

Economics of Farm Size

It is found that most of the peasants in Assam have been suffering from diseconomies of small scale and subject to tenantal disinsentives. But it is important to find out precisely what proportion of peasant families and farm-tractareage is subject to size disabilities and tenantal disinsentives and what proportion is free from these handicaps. After a detail examination of the concepts of work unit, plough unit and income unit and then applying these concepts to the farm management data of various states in India, Khuaro arrived at some estimate of farm-size below which a farm is palpably inefficient and
un-economical so long as techniques of production remain what they are at present. There must be a size of farm below which its output is too small to maintain the family at a reasonable standard of living and this minimum size represents the concept of a minimum income-unit of land. There must also be a size of farm below which the family manpower, including managerial labour cannot be fully absorbed in gainful employment. This gives the concept of work-unit of land. Moreover, there is a size of farm below which the farm becomes too small to absorb effectively the services of a pair of bullocks, and hence entails high costs of bullock maintenance per unit of land and per unit of output. This is called the concept of a plough-unit of land. The minimum size of holding which makes it worthwhile to cultivate land efficiently is accepted as one which fulfils the norms of income unit, work unit and plough unit.

On the basis of the analysis of farm management data of different states in India, Khurao obtained 3 hectares as the minimum plough-unit as well as work-unit and 6 hectares as the minimum income unit. But, keeping in view the possibility that a three to four-fold increase in per hectare gross productivity would be brought about in many parts of India in near future by technological change, he suggested a 2-hectare limit as the dividing line

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between incentives and disincentives. On the above basis, it may be calculated that 90 per cent of the total holdings and 56 per cent of the total operated areas in Assam are disincentive-ridden and economically inefficient. The analysis of the farm management data on Nowgong district in Assam will clarify this statement more obviously. Table 11.2 is used to derive the work unit of land.

Table 11.2

AVERAGE ANNUAL EMPLOYMENT OF AN ADULT MALE
FAMILY WORKER (in 8-hour days), 1968-69

<table>
<thead>
<tr>
<th>Farm size group</th>
<th>Employment inside the farm</th>
<th>Employment outside the farm</th>
<th>Total employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 - 1.82</td>
<td>90.11</td>
<td>156.19</td>
<td>256.30</td>
</tr>
<tr>
<td>1.83 - 2.43</td>
<td>109.95</td>
<td>183.85</td>
<td>293.80</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>112.00</td>
<td>155.42</td>
<td>265.42</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>110.98</td>
<td>168.02</td>
<td>279.00</td>
</tr>
<tr>
<td>Above 4.45</td>
<td>130.83</td>
<td>145.33</td>
<td>276.16</td>
</tr>
<tr>
<td>Overall</td>
<td>113.00</td>
<td>161.59</td>
<td>274.59</td>
</tr>
</tbody>
</table>

(Source - F.M.S. Nowgong District, ibid, p. 78)

Since the farm management data are not available for Assam as a whole, those available only for Nowgong District are used here as representative of the state.
It appears from the table 11.2 that in the two smaller size-groups below 2.43 hectares, annual family employment inside the farm is restricted to 90.11 and 109.95 days respectively. As a result, employment has to be found outside the farm to the extent of 156.19 and 183.85 days respectively in these two size-groups. This clearly indicates the serious underutilisation of family farm workers in the farms of less than 2.43-hectare size. But in the higher size groups above 2.43 hectares, farm employment rises from 109.95 days to 130.85 days. Because of higher employment inside the farm in the higher size-groups, the need for non-farm employment diminishes almost gradually. Farm employment is, therefore, somewhat comfortable in the higher size-groups. Thus it seems that a 2.43-hectare size is the dividing line between underutilisation and adequate employment of family labour. Therefore, 2.43-hectare size may be taken as the minimum work-unit of farm in Assam, since the relevant conditions in other districts of the state is not much different from those prevailing in Nowgong.

To find out the 'plough unit of land', data relating to the average number of bullocks owned per farm and per hectare and the area commanded by a pair of bullocks are used (Table 11.3).

The average number of bullocks per farm increases and that of per hectare decreases as the increase of size of the farms. In the higher size-groups, the average area commanded by
<p>| Farm size- | No. of bullocks | Area commanded by a pair of bullocks | Mean size of holding | Pairs of bullocks required to cover holding of mean-size |</p>
<table>
<thead>
<tr>
<th>groups (in hectares)</th>
<th>Per farm</th>
<th>per hectare (in hectares)</th>
<th>(in hectares)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 - 1.82</td>
<td>2.20</td>
<td>1.63</td>
<td>1.22</td>
<td>1.05</td>
</tr>
<tr>
<td>1.83 - 2.43</td>
<td>2.31</td>
<td>1.05</td>
<td>1.89</td>
<td>2.18</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>2.94</td>
<td>1.05</td>
<td>1.86</td>
<td>2.73</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>3.36</td>
<td>0.89</td>
<td>2.24</td>
<td>3.77</td>
</tr>
<tr>
<td>Above- 4.45</td>
<td>4.86</td>
<td>0.73</td>
<td>2.72</td>
<td>6.37</td>
</tr>
<tr>
<td>All farms</td>
<td>3.06</td>
<td>0.95</td>
<td>2.10</td>
<td>3.22</td>
</tr>
</tbody>
</table>

(Source - F.M.S. Newgong District, Ibid, p. 100)
a pair of bullocks shows an increasing tendency which indicates that in these size-groups, the bullocks are more economically utilised. It is clear from the table that in holdings of less than 1.83 hectares, bullock requirement is of 0.86 pair so that the indivisibility of a single pair leads to a serious under-utilisation.

In the size-group of 1.83 to 2.43 hectares a pair is adequately utilised, while in the size-group of 3.25 to 4.45 hectares, the bullock requirement rises to 1.63 pairs, and hence a single pair becomes an insufficient unit. It is now seen that there is serious under-utilisation of draught cattle in majority of the farms. The dividing line between under-utilisation and over-stretching would be the 2.43-hectare size.

In order to get the 'income unit of land' the data on the farm business income per farm and per hectare of cultivated area are utilized (Table 11.4). It is seen from table 11.4 that the income per farm increases rapidly as the farm size increases. But the income per cultivated hectare shows a declining trend as the increase in farm size-group. As the size of 4.45 hectares is reached, the farm business income increases to

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Farm business income is the gross income from farm output minus input on cost A basis which includes all cash and kind expenses actually incurred and rent paid for leased-in land.
Table 11-4

ESTIMATE OF FARM BUSINESS INCOME (1968-69)

<table>
<thead>
<tr>
<th>Farm size-group (in hectares)</th>
<th>Income per farm (in Rs.)</th>
<th>Income per hectare of cultivated area (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 - 1.82</td>
<td>1,553.25</td>
<td>1,155.99</td>
</tr>
<tr>
<td>1.83 - 2.43</td>
<td>2,190.37</td>
<td>1,002.09</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>2,667.58</td>
<td>960.67</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>3,243.45</td>
<td>860.03</td>
</tr>
<tr>
<td>Above 4.45</td>
<td>4,505.13</td>
<td>707.79</td>
</tr>
<tr>
<td>All farms</td>
<td>2,799.39</td>
<td>868.96</td>
</tr>
</tbody>
</table>

(Source - F.M.S. Newgong District, ibid, p. 160)

more than Rs. 3,000, but does not reach the income norm of Rs. 4,000 required in Assam. This clearly shows that a farm deriving a farm business income below Rs. 4,000 is not economically viable in the state, where the income unit of land lies above 4.45-hectare size.

In Assam, under the circumstances as prevailing during 1968-69, the income unit appeared to be 4.45-hectare size, which was much lower than the all-India average of 6 hectares. This is,

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mainly because the input values in Assam are very much insignificant and the output values are relatively high.

The above analysis leads to the conclusion that with the prevailing techniques, each of the two minima of plough unit and work unit stands at 2.43-hectare size, but the minimum income unit seems to be 4.45-hectare size. In a consideration of the minimum economically justifiable size of a farm, there is a need for reconciliation of the three minima. Reconciliation is possible either at a size of 2 hectares or at 4 hectares. In the first case, this can be done by letting some family workers and bullocks to be fully occupied, while sending other family workers to seek some non-farm employment. In the case of a size higher than 4 hectares, reconciliation is possible by providing adequate farm income to the family members, while hiring in some human and bullock labour over and above the services of the family members and the single pair of bullocks, or having two pairs and hiring out one pair for some time. Khuro has adopted a 2-hectare limit to be the dividing line between incentives and disincentives and between efficiency and disability of a farm for all India condition, even though the norms of plough, work, and income suggest a minimum size of 3, 3 and 6 hectares respectively in the current situation. For Assam, a 2-hectare size may be taken as the norm, reconciling the plough, work and income norms of 2.43, 2.43 and 4.45 hectares respectively. The income unit of 4-hectare size is
CEREAL SURPLUS AND DEFICIT AREAS
1971-72

ASSAM
CEREAL SURPLUS AND DEFICIT AREAS
1971-72

SUFFICIENCY INDEX
SURPLUS
+ 0.01 TO +8.39
DEFICIT
-28.8 TO -112

-172
+0.83
+2.53
+3.78
-185

40 0 40 80 120 KM
ASSAM
DISTRIBUTION OF WOODEN PLOUGH
1972
PER 100 HECTARES OF GROSS CROPPED AREA
ABOVE 60 (STATE AVERAGE 51.21)
50 - 60
40 - 50
30 - 40
BELOW 30

ASSAM
IRRIGATED AREA
1970-71
AS % OF NET SOWN AREA
ABOVE 15 (STATE AVERAGE 7.92)
10 - 15
BELOW 10
NIL

Fig. 11/9

Fig. 12/1
reduced to 2-hectare size on the basis of the consideration that a three to four-fold increase in per hectare gross productivity might be brought about in Assam if the modern techniques of cultivation are applied. The existing farms of less than 2-hectare size will not only be disabled themselves, they will rather be a burden on agriculture and a drag on industrialisation. The spatial distribution of the economically non-viable operational holdings and areas in the state are presented in Figs. 11.1 and 11.2 respectively. Ultimately it has become clear that the majority of the peasant households in Assam have not possessed economically viable size of holding and also that farm size or land has been still a critical limiting factor for agricultural growth and economic progress of a major section of the peasantry, following the classical Ricardian theory.

11.2 LABOUR

Labour is one of the most important factors of production in traditional peasant agriculture. But it is not merely the quantity, but the quality of labour which is more important for agricultural growth and development. The major capital stock of an industrially advanced country is said to be the capacity and training of its population to use the knowledge amassed from tested findings and discoveries of empirical science effectively.¹³

¹³ Kindlesberger, C.P., op. cit., p. 104
There is a surplus labour in peasant agriculture of Assam, most of whom are unskilled, illiterate and poor. Such an excessive supply of unskilled work force is a major constraint, rather than a stimulating factor like capital, technology and organization.

Fig. 11.5 shows the proportion of farm workers to the total rural workers in Assam. On the average, 84.37 per cent of the rural workers are engaged in primary employment (Fig. 11.4). Among the different sectors of economy, agriculture accounts for the largest percentage of the working population. Fig. 11.3 reveals clearly that farm worker's ratio is high in those areas which are industrially more backward. On the other hand, it is low in the districts where tea plantation is important.

An interpretation of Fig. 11.5 brings to light the very high proportions of hired agricultural labourers in Cachar followed by Goalpara and Nowgong, where the pressure of population on agricultural land is very high (Fig. 11.8), in spite of the fact that the total sown area has been increased by the intensity of cropping in these three districts (Cf. Table 5.1).

The density of cultivators per 100 hectares of cultivated area is mapped in Fig. 11.6 which clarifies that the two hills districts and the Cachar district have relatively high densities of cultivators. So far the hills districts are concerned, this is the result of topographical constraint, limiting the net
area sown (Fig. 3.2) in proportion to the number of cultivators as also the 'jhuming' method of cultivation which requires higher cultivator/land ratio than in the plough-and-bullock method. The cultivator's density is high in Cachar, because of high rural population density (228 persons per km²), as also, because, high percentages of total geographical area are under forests, tea gardens and swamps. Highest degree of concentration of land holding with a concentration ratio of 0.61 (Table 10.6) in this district also contributes to the high cultivator/land ratio.

Moderate density of cultivators is observed in Dibrugarh, Nowgong, Goalpara, Kamrup and Lakhimpur in that order. Contrary to the common notion, Dibrugarh betrays a relatively high density, because of high pressure of population on the limited cultivated land (only 16 per cent of the total area of the district), high percentage of forest land (35, Appendix B) and the predominance of socio-economically backward lower caste population (63 per cent of the total population, Tables 9.1 and 9.3) in the rural areas whose occupational diversification is still very insignificant with only 3.29 per cent of the total rural workers being employed in secondary sector. Nowgong, with no industry worth the name and a high proportion of essentially agricultural immigrant settlers (Table 2.7), records a relatively high cultivator's density in this group.
In spite of relatively high rural density in Kamrup, the cultivator's density is relatively lower among the districts of this group. This is because of the facts that a relatively high percentage of net sown area has been recorded in this district (Appendix B) and employment in non-farm activities, especially in the tertiary sector (14 per cent) is significant in the rural areas. The impact of the Guwahati City on the neighbouring rural areas is also another reason for low-moderate density of cultivators here. Goalpara maintains a moderate density above the state's average. A large area under forest (Appendix B), restricting the net sown area on the one hand, and a high percentage of peasant immigrants on the other (Table 2.7), result in a moderate density of cultivators in this district. Although Lakhimpur shows a moderate density of cultivators, it is high in relation to its very low rural density (only 122 persons/km²). This is because of the fact that a vast tract in Dhemaji, Dhubri, and Lakhimpur thanas remain submerged for a long period of the year, its foot hill areas are covered with Reserved Forest, and the district is industrially most backward. Relatively low density in Barpang is brought about by a low percentage of net sown area and a probably underenumeration of a large number of immigrant peasants, many of whom might return themselves as agricultural labourers and graziers, although they are, in fact, cultivators.
It is interesting to note that Sibsagar records the lowest cultivator's density among all the districts of the state. A very low percentage of rural workers engaged in cultivation (only 50 per cent), high rural literacy (34.38 per cent), high percentage of rural workers employed in tertiary occupations, particularly in services (9.05 per cent) and almost absence of immigrant peasants (Table 2.7) are some of the causes responsible for low density of cultivators in this district.

The above analysis reveals that pattern of land use, topography, rural population composition, rural literacy, occupational structure, farming methods and farm technology used, etc. determine the spatial variation of cultivator's density.

**Surplus Labour**

The problem of surplus labour has been created in Assam by the over-pressure of rural population on cultivable land and also the concentration of land holding in the hands of a minority of landowners.

Fig. 11.7 clearly manifests that a substantial proportion of the farm workers is redundant everywhere in Assam, though there is spatial variation of it. The problem of surplus labour is more acute again where the cultivator's density is relatively high. Cachar recorded the highest percentage of surplus farm workers followed by the two hills districts, because of the same reasons as explained already. Dibrugarh, Nowgong
and Goalpara also registered surplus farm workers above the state's average of 60.24 per cent. The percentage is below the state's average value in each of the districts of Kamrup, Darrang, Lakhimpur and Sibsagar.

Unless the surplus labour is removed from agriculture, any savings from the producer's surplus for capital investment cannot be expected. The surplus man-power from agriculture can only be removed if there are possibilities of their employment in other sectors of the economy. Industrialisation is, therefore, the only remedy to absorb surplus labour. Technological innovation in agriculture also can create a condition where a large number of workers is required in the agricultural sector itself.

The surplus population on agricultural land may be expressed with the index of 'relative coefficient of over-population'. The indices derived for different districts of the state are mapped in Fig. 11.8 which reveals that all districts of Assam are over-populated, although there is spatial variation. The over-population is found to be the highest in Cachar and the lowest in K.A. and H.O. Hills. There is an apparent paradox that there is higher relative coefficient in Sibajgarh though the

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14 Mulkerjee, R.K., 1958, Food Planning For Four Hundred Millions. London, p. 6

The relative coefficient of over-population is the quotient obtained by dividing 0.40469 hectares (equivalent to one acre) by per capita total sown hectarage. Because one acre of cropland is assumed to be indispensable for the nourishment of a person.
rural population density is relatively low and opposite is the case in Kamrup. This may be explained by the fact that in the former region, percentage of total sown area is very small, and, the intensity of cropping is also very low. In Kamrup, the percentage of gross sown area and intensity of cropping are higher than those of the former. In all other districts of the plains, the rural population density varies directly with over-population, except where there is double or multiple cropping.

The two hills districts have relatively low pressure of population in spite of higher cultivator's density, because of the 'jhum' cultivation where relatively small plots of land can support a larger number of persons at the subsistence level.

**Availability and Utilisation of Labour**

Employment of family members in agriculture is one of the most important characteristics of peasant agriculture. Of the total population in the 150 sample farms of Nowgong, 31 per cent are adult male, 26 per cent adult female and 43 per cent children. As most of the female workers are not connected with farm works, only 31 per cent of the total population in the district is available as the labour force for carrying out farm works.

The average size of family of the total sample farms is composed of 8.24 members compared to 6 members in the state
according to 1971 census. The per hectare members show a decreasing trend as the farm size increases.

Out of the total population, about 35 per cent are returned as earners and 67 per cent dependents. The average number of earners per farm and per hectare according to farm size-group are shown in table 11.5.

Table 11.5

AVERAGE EARNERS ACCORDING TO FARM SIZE-GROUPS, 1968-69

<table>
<thead>
<tr>
<th>Farm size-groups (in hectares)</th>
<th>Average No. of Earners</th>
<th>Per Farm</th>
<th>Per Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 - 1.82</td>
<td>2.13</td>
<td>1.58</td>
<td></td>
</tr>
<tr>
<td>1.85 - 2.45</td>
<td>2.44</td>
<td>1.12</td>
<td></td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>2.91</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>2.73</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Above 4.45</td>
<td>3.55</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>2.74</td>
<td>0.84</td>
<td></td>
</tr>
</tbody>
</table>

(Source: P.M.S., Nowgong District, op. cit., p. 75)

The studies in the economics of farm management in Nowgong district further reveal that the maximum number of days utilised in crop production are in the months of July and August as ploughing and transplanting the main crop, i.e. winter paddy, are undertaken during this season. From the middle of November, the family workers are busy in harvesting and threshing of winter paddy. February to May are also relatively busy months
as ploughing, sowing and weeding operations of summer paddy, winter paddy ('Bog') and jute take place during this period. Late September, October and January are the lean months for the peasant, and, therefore, they seek works other than crop production during these months. It is also found that out of the total man-days utilised by the family workers on the average during a year, i.e. 272.02 man-days, as high as 228.81 man-days are engaged in farm employment and only 43.21 man-days in non-farm employment, indicating that there is little scope for employment of the family workers outside his own farm. Besides, a family member on an average is employed for months of the year and he lives without any work for the remaining 3 months, leading to the problem of seasonal unemployment and serious loss of available human energy. The percentage of unemployed days would be more if the actual daily working hours were counted and not converted into 8-hour man-days, since in the off season, there is little possibility of working for full 8 hours per day. Rural-based industries and handicrafts, which would have employed the family workers for these three months, have been destroyed by

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Farm employment consists of works inside the peasant's own farm that is works in crop production and other works relating to the farm operation. Labour offered in exchange or gratia outside the peasant's own farm is also included in farm employment.
Table 11.6
PERCENTAGE OF EMPLOYMENT AND UNEMPLOYMENT OF ADULT MALE WORKERS, 1968-69

<table>
<thead>
<tr>
<th>Farm size-group (in hectares)</th>
<th>Employment in Productive Works</th>
<th>Unemployment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of 8-hour days</td>
<td>Percentage</td>
</tr>
<tr>
<td>0.01 - 1.82</td>
<td>237</td>
<td>64.94</td>
</tr>
<tr>
<td>1.83 - 2.43</td>
<td>274</td>
<td>75.07</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>248</td>
<td>67.95</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>260</td>
<td>71.23</td>
</tr>
<tr>
<td>Above 4.45</td>
<td>260</td>
<td>71.23</td>
</tr>
<tr>
<td>All Farms</td>
<td>256</td>
<td>70.14</td>
</tr>
</tbody>
</table>

Note - The labour spent on social and family affairs is not included in productive work.

(Source - Fdi.S. Howgong District, ibid, p. 85).

Table 11.6 shows that the family workers of the smallest size-group remain unemployed for more man-days than those of the higher size-groups. Small-sized farms are, therefore, not adequate for full utilisation of the family workers of a peasant family. But there is an exception to this general rule only in size-group of 1.83 - 2.43 hectares. This may be explained by the fact that such a size of the farm with archaic implements and
limited resources fully engages the family worker without the need of hiring his labour out or hiring casual labour in for his farm. Below this size, a peasant is forced to hire out his labour, and above it a peasant has the need and capacity to hire casual labour in for his farm. The peasants who have farms in the size-group of 1.83 - 2.43 hectares represent the true peasantry. In the field work, this author observed that a village, where more than 60 per cent of the total peasant families have this farm size, was socio-economically backward in comparison to the villages having unequal distribution of farm sizes. The marginal peasants in the size-group of 1.83 - 2.43 hectares, find it difficult to educate their children as they require their help in farm activities. They lack adventurism and mobility. But the peasants owning higher size of holding hire casual labour in, and can educate their children for non-agricultural jobs who can go to services or business. Even the sub-marginal peasants can be adventurous in seeking various kinds of non-agricultural works.

The situation as exposed by the marginal peasants indicates that the peasant mode of production is anti-progressive. As such growth and development of agriculture cannot be expected from the true peasants who have a tendency to cling to the soil at an extremely low level of living.

The female members of the peasant families are mostly found to be busy only in household activities and rarely connected
with farm works. Only about one-sixth of the total female labour is utilized annually in productive works. An adult female worker, on the average, is employed only for 6 months during a year. Out of this period of employment, she is engaged for 157.26 man-days in social and family affairs.

Some of the peasant families employ servants on annual terms essentially for various farm works. Number of such servants is larger in the households of larger farm-size.

The proportion of family labour to hired labour used per farm is 3 : 1. But the highest proportion of family labour to hired labour is in the second size-group (22 : 3) and it is lowest in the last size-group (63 : 37).

### Table 11-7

**UTILIZATION OF HIRED LABOUR PER FARM, 1968-69**

<table>
<thead>
<tr>
<th>Farm size-group (in hectares)</th>
<th>Family Labour</th>
<th>Hired Labour</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Man-day</td>
<td>Percentage</td>
<td>Man-day</td>
</tr>
<tr>
<td>0.01 - 1.32</td>
<td>137.03</td>
<td>84.12</td>
<td>25.87</td>
</tr>
<tr>
<td>1.33 - 2.43</td>
<td>193.00</td>
<td>87.56</td>
<td>27.41</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>238.73</td>
<td>81.99</td>
<td>52.44</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>224.17</td>
<td>70.90</td>
<td>92.00</td>
</tr>
<tr>
<td>Above 4.45</td>
<td>324.96</td>
<td>63.47</td>
<td>187.04</td>
</tr>
<tr>
<td><strong>All Farms</strong></td>
<td>222.16</td>
<td>74.90</td>
<td>74.43</td>
</tr>
</tbody>
</table>

(Source - P.*S., Nowgong District, ibid, p. 146).
Table 11.7 presents clearly that as farm size increases, family labour decreases, while hired labour increases except in the second size-group. The total labour is better utilized in higher size-group. But they do not get adequate works to be done in holdings of small size. Also the family labour used per hectare cultivated area varies inversely, while the hired labour directly with the increase of farm sizes. Thus it is seen that the small peasants have to depend largely on family labour, while the big peasants employ hired labour significantly in farm works.

From table 11.8, it is evident that the income from crop production per farm increases and per hectare of cultivated area decreases with the increase of farm size. Though the family labour income per hectare is more in the lower size-groups of farms than in the higher size-groups, the former are economically not viable with only an average income of less than Rs. 1,000.00.

Another revelation from table 11.8 is that the average return per family farm worker per calendar day is extremely low (only Rs. 1.19), the highest being only Rs. 1.45 and the lowest being Rs. 0.75. The return per family worker per year also increases as the size-group increases. This is clearly an indication that a large-sized holding is more beneficial to the farm workers than the small-sized holdings.

The above analysis brings to light that the peasant agriculture in Assam is carried on by a surplus labour force on
poor agricultural resources at an extremely low level of living. The poor, unskilled labour force of the state cannot break the vicious circle of poverty, and, therefore, the peasant agriculture with tiny-sized holdings in Assam cannot be a profitable enterprise which only would have improved the quality of the agricultural workers so as to bring agricultural innovation.

Table 11.3
FAMILY LABOUR INCOME FROM CROP-PRODUCTION, 1968-69.

<table>
<thead>
<tr>
<th>Farm size-groups (in hectare)</th>
<th>Per Farm (₹)</th>
<th>Per hectare cultivated area (₹)</th>
<th>Return per family labour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per year (₹)</td>
<td>Per day (₹)</td>
<td></td>
</tr>
<tr>
<td>0.01 - 1.82</td>
<td>549.32</td>
<td>407.52</td>
<td>274.66</td>
</tr>
<tr>
<td>1.83 - 2.43</td>
<td>966.38</td>
<td>442.14</td>
<td>431.42</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>1024.91</td>
<td>369.09</td>
<td>379.60</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>1330.30</td>
<td>366.01</td>
<td>530.88</td>
</tr>
<tr>
<td>Above 4.45</td>
<td>1650.19</td>
<td>259.27</td>
<td>530.61</td>
</tr>
<tr>
<td>All Farms</td>
<td>1102.10</td>
<td>342.12</td>
<td>435.61</td>
</tr>
</tbody>
</table>

(Source - F.M.S., Nowgong District, ibid, p. 160).

11.3 CAPITAL

Capital occupies the central position in the theory of economic development. In order to increase the output per worker, the capital/labour ratio must be increased, when land/Capital labour ratio declines./includes the extension of known inputs
such as irrigation and fertilizers as well as the use of entirely new factors such as HYV seeds with the associated package of inputs.

According to the estimation made by Rao on the contributions of different factors of production during 1961-71 in India on the basis of production function, land contributed 9.6 per cent, labour 28.4 per cent and capital and knowledge together the remaining 63 per cent to the growth in agricultural output. In Assam, the miserably role of capital can be noticed from the following few lines extracted from the 'Studies in the Economics of Farm Management in Noogong District (Assam)'. The innovation in agriculture is not satisfactory. The majority of the cultivators in the selected villages follow traditional method of cultivation. A few cultivators have used tractors for the cultivation of jute, summer paddy, and sugarcane, and power pump for irrigation of HYV paddy. The selected villages usually use home-produced seeds. A very small quantity of HYV paddy seeds are used. Only a few farms use chemical fertilizers. The most commonly used manure is the farm yard manure'. Besides, the analysis of the value of operational assets invested per hectare shows that the major investment made by the peasants in agricultural assets is in the form of land which accounts for 91 per cent of the value of total operational assets of the farms followed by 5 per cent in livestock.

3 per cent in farm buildings and only 1 per cent in implements and machinery. Distressing condition of the farm economy and the insignificant role of capital in the peasant agriculture of Assam can be guessed from table 11.9.

Table 11.9

<table>
<thead>
<tr>
<th>Farm size groups (hectares)</th>
<th>Total capital investment (including land value) per farm (£.)</th>
<th>Total output per farm (£.)</th>
<th>Capital turn over in percentage</th>
<th>Capital/output ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 - 1.82</td>
<td>9,278.70</td>
<td>2,081.27</td>
<td>22.43</td>
<td>4.46</td>
</tr>
<tr>
<td>1.83 - 2.43</td>
<td>12,084.99</td>
<td>2,995.67</td>
<td>24.79</td>
<td>4.43</td>
</tr>
<tr>
<td>2.44 - 3.24</td>
<td>16,190.98</td>
<td>3,628.36</td>
<td>22.41</td>
<td>4.46</td>
</tr>
<tr>
<td>3.25 - 4.45</td>
<td>23,690.92</td>
<td>4,434.31</td>
<td>18.72</td>
<td>5.34</td>
</tr>
<tr>
<td>Above 4.45</td>
<td>32,409.10</td>
<td>6,729.27</td>
<td>20.76</td>
<td>4.32</td>
</tr>
<tr>
<td>All Farms</td>
<td>18,435.84</td>
<td>3,915.98</td>
<td>21.24</td>
<td>4.71</td>
</tr>
</tbody>
</table>

N.B. Here the capital includes the values of land, farm buildings, livestock, implements and machineries and also the operational cost such as seeds, manures and fertilisers, etc.).

(Source = F.W.S., Newgong (Assam), op. cit. p. 166).

Table 11.9 indicates that the overall capital turn over is approximately 1/5th of the total capital invested and the overall capital/output ratio is roughly 5 : 1. From these figures, it
is seen that capital has been playing a very insignificant role in the peasant agriculture in Assam.

The above analysis makes it evident that peasant agriculture in Assam has not become a profitable enterprise. Whatever little benefit the peasants get, is derived only from the two traditional factors of production, viz. land and labour. The small peasantry of Assam within the prevailing ambit of their socio-cultural milieu are incapable of any kind of farm organisation and management, necessary for the adoption of modern inputs, techniques, and knowledge. In such a situation, capital investment is bound to be weak.

11.4 ORGANISATION

In factory production, different persons perform specialised services. But in peasant agriculture, a single peasant must perform all functions relating to his farm. The managerial task of buying and selling is not an important part in the peasant economy. But agricultural development depends on farms becoming more commercial with increasing purchases of production supplies and equipments, as also sales of outputs. It is important to agricultural development that farmers grow in managerial ability so that they may competently take advantage of every opportunity open to them, and make their farm as productive as possible with an increasing margin between the costs and returns of his farming
In Assam, the peasant's farming is at a very low level of organisation, as most of the farms are uneconomic and cannot produce surplus. As such the peasants are inefficient for carrying out farm business. Moreover, most of the peasants are illiterate and tradition-bound. As a result, the managerial ability has not been developed among the peasants. Their work is confined to the operations of crop production and cattle rearing in the traditional way. The only managerial role the chef d'entreprise has to play is limited to employing his family members in the farm, providing them food and other daily necessities, and to looking after the farming operation carried out in accordance with the seasonal rhythm.

As the peasants progress towards the establishment of modern farms, not only are new tasks added, but they have to do the old operations in a new way, besides involving themselves in more commercial activities, risk-taking and decision-making. Then the peasants are converted into farmers. Since a single farmer cannot perform all these specialised works, he must employ skilled persons in different branches of the specialised works of the farm. So his status would then be that of a farm-manager or entrepreneur. Organisation prepares the blue prints of all kinds

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of agricultural activities within and outside the farms with a view to make agriculture a profitable business. But the economic organisation of family farming without the patronage of Government is possible only in a developed capitalist country where the farmers are educated, trained and skilful. In the underdeveloped region like Assam, the poor peasants with uneconomic size of holding, lack of capital and technical know-how cannot come out of the vicious circle of poverty and associated archaism of peasant mentality nor do they feel the necessity of economic organisation as stated above.

In socialist countries, the Government plays the role of the organiser, replacing the family. But in a developing nation like India, neither the Government nor the individual peasant provides the basis for the organisation of agriculture. There is no denying the fact that after Independence, the Government of Assam, as in other states of India, has been taking various measures for agricultural growth and development through the Five Year Plans. Agriculture University, Research and Training Centres, Community Development Blocks and Rural Panchayats have been set up, large paraphernalia of Government Departments without any co-ordination among themselves, have been created for agricultural administration, and also inputs, technology, credit and extension services are distributed.
There seems to be a big gap between the actual man in the field and the Government which acts as the external agency only and not as an internal partner of the peasants in their farm organisation. For example, the Gram Sevaks (the lowest level extension officers to guide the peasants as to how to apply the modern methods of cultivation) are alien to the peasants who cannot comprehend what such officers advise them to follow. The Government can provide effective organisation only in the socialist countries where it can take cogent measures, if necessary, for the proper implementation of its plans and programmes. Even in capitalist economy, failure of private enterprise leads to the substitution of Government organisation for the private enterprise in certain cases. Thus the Government's role is monopolistic in socialist economy and complementary in capitalist economy. In between these two extremes an under-developed peasant economy is automatic, and unorganised and the Government's attempt to transform it into a modern farm economy is of little effect. The reason is that the peasants do not feel the need of organisation as such in the required scale of economy, nor do the Government like to apply compulsion, although the latter is always ready to help the peasants if they so desire. Only the rich peasants, therefore, are taking all sorts of facilities and incentives provided by the Government, while the mass of peasantry, for their various kinds of limitations, are being deprived of all such advantages.
A brief review of the gigantic organisational set-up of bureaucratic machinery of the Government of Assam and the huge amount of money spent under the head of agriculture during the Five Year Plans shows that only a little has been trickling down through the thick sieve of top-heavy Government organisation to the peasants in the actual field and no organisational change at the farm level has been effected so far.

The Department of Agriculture which is responsible for agricultural growth and development in Assam, is headed by one Director. He is assisted by some Joint Directors in charge of various branches and programmes. Each of them is assisted by several technical personnel.

At the field level, an Agricultural Inspector is placed in charge of each subdivision with an adequate staff to assist him. For the purpose of execution of the plans and programmes, the State is divided into four sub-divisions, viz. the Upper Assam Valley, the Lower Assam Valley, the Surma (Barak) Valley, and the Hills Districts — each under an Asst. Deputy Director with adequate field and supervisory staffs. The three wings of the Engineering Cell — irrigation, mechanical and electrical — are placed under the control and management of the Chief Engineer (Agri.). The irrigation section was, however, pooled in 1974 with the newly created Irrigation Department. It is to be noted that in order to tackle the special environment and
problems of the two hills districts, a special set-up under the State Agriculture Department has been created. Moreover, the Departments of Community Development (C.D.), Panchayati Raj, Co-operative, Irrigation and the Flood Control help the Agriculture Department in carrying out the field studies and researches and in executing the programmes.

All departmental activities in the rural sector are channelised through the C.D. and Panchayati Raj Departments. The C.D. department covered the entire state by the end of the Third Plan with 121 blocks in the plains and 9 blocks in the hills, including 17 Tribal Development Blocks set up in the areas inhabited mainly by the plains tribes. Each block is manned by a Block Development Officer (B.D.O.), some Extension Officers, and some Gram Sevaks.

The existing Panchayat Organisation is a two-tier structure with 664 Gaon Panchayats and 20 Mahkuma Parishads. The Gaon Panchayats are responsible for the preparation and implementation of all rural development programmes at the village level. The Mahkuma Parishads formulate sub-divisional plan schemes which are examined by the State Planning Board for consolidation and incorporation of them in the broad plan-frame of the state.

The role of the Co-operative Department is to see that the cooperatives can function smoothly in providing rural credit,
facilities for marketing, processing and distribution products, and also for the supply of inputs to the peasants. The cooperative movement has so far made extremely slow progress in Assam. Even the main function of the cooperatives — to meet the credit needs of the peasants — has not been performed satisfactorily, mainly due to managerial inefficiency and lack of organized and devoted participation. As a result, there are mounting arrears, large scale wilful defaults and depressed financial status of the societies. The performance of the primary Agricultural Credit Societies seems to be very poor as 2,878 such societies had the working capital of 841 lakhs and the deposits of 52 lakhs only; loans advanced were 202 lakhs, loans outstanding were 629 lakhs and loans over due were 498 lakhs, accounting for 79.2 per cent of the outstanding loans as on 30th June, 1971.

Besides these Primary Credit Societies, the State Cooperative Bank, Central Cooperative Banks in different plains districts, the Central Banks and the Commercial Banks also supply credits to the farmers. But the data of credit supply by these banks to the peasants are not available. It is, however, known that the Commercial Banks have been trying to replace the position of the cooperatives as the agricultural creditors.

Against such a gigantic organizational set-up of the Government for agricultural development of the state, the achievement in the actual field has been very meagre. During the First
Five Year Plan (1951-56), an expenditure of Rs. 362.71 lakhs was incurred on agricultural schemes as a result of which a potential of 2.75 lakh tonnes of additional foodgrains production was achieved. There was marginal increase in the production of cash crops like jute and oil seeds, but sugarcane registered a slight decrease. There was only marginal increase in the areas of foodgrains and jute. The areas under other crops remained almost stationary. The marginal achievement in the agricultural sector during this plan period was attributed to the good monsoon and not to the plan efforts. During the Second Five Year Plan (1956-61), Rs. 757.57 lakhs were spent, but there was considerable downward trend in agricultural production. Against the target of additional food production fixed at 3.85 lakh tonnes, the actual achievement was only 1.58 lakh tonnes. The cause attributed for such a poor performance was mainly the fluctuation in weather conditions. The Third Plan (1961-66) spent Rs. 1,220 lakhs on the agricultural sector. But the achievement was only 1.20 lakh tonnes of additional foodgrains which is about 30 per cent of the target. There was marginal short fall in jute production. During the Ad-hoc Annual Plans (1966-67 — 1968-69), an amount of Rs. 1,132.27 lakhs was spent for the entire agricultural sector. Production of foodgrains increased from 17.61 lakh tonnes at the end of the Third Plan to only 20.41 lakh tonnes during this period, but there was a decline in the production of oil seeds and jute.
The Fourth Plan (1969-74) spent Rs. 3,672 lakhs on the head of agriculture and the production of food grain was only 23.82 lakh tonnes which fell short of 1.18 lakh tonnes from the target, even though 2.32 lakh hectares were covered under HYV paddy.

An idea of the overall performance of agriculture during the plan periods under the impact of the Government organization can be had from a study of the agricultural productivity in Assam. It is observed that there has been no significant rise in the crop yields and that yields per hectare had remained stationary throughout the whole plan period.

**Table 11.10**

**YIELD RATES IN KG PER HECTARE**

<table>
<thead>
<tr>
<th>Crops</th>
<th>Yield per hectare in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>918</td>
</tr>
<tr>
<td>All food-grains</td>
<td>889</td>
</tr>
</tbody>
</table>

(Source - Report of Assam Agriculture Commission, ibid, p. 63).

Table 11.10 reveals that the peasant agriculture in Assam is still neutral to the efforts of the Government made with a colossal amount of expenditure. Totally inadequate infrastructure, poor research base, uncoordinated field efforts and negligence of the peasants are some of the causes leading to this dismal
situation. A comparison of the compound rates of productivity of the principal crops in Assam with that in India during 1951-72 gives the same picture as mentioned above.

Table 11.11

COMPOUND RATE OF PRODUCTIVITY IN PERCENTAGE, 1951-72

<table>
<thead>
<tr>
<th>Crops</th>
<th>Assam</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>0.0</td>
<td>1.2</td>
</tr>
<tr>
<td>Jute</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Rape and Mustard</td>
<td>0.2 (-)</td>
<td>1.4</td>
</tr>
<tr>
<td>Potato</td>
<td>1.4 (-)</td>
<td>0.6</td>
</tr>
<tr>
<td>Sugarcane (Gur)</td>
<td>1.6</td>
<td>1.2</td>
</tr>
</tbody>
</table>

(Source - Report of Assam Agriculture Commission, ibid, p. 66)

In comparison to India where increase in agricultural productivity had been 1.47 per cent at compound rate of growth during 1961-71, when largest impact of technology had been made elsewhere in some other states, the productivity in Assam rose by only 0.3 per cent. The annual increase in production of food-grains in Assam was 2 per cent at compound rate of growth, whereas in India it was 2.8 per cent. But this gain came from area increase rather than rise in land productivity\(^\text{19}\).

\(^{19}\) All information and data regarding the Government Organization and plan achievements are taken from the Report of the Assam Agriculture Commission, 1975, pp. 48-67.
The above analysis has amply exposed the failure of the Government organisation in agricultural planning and development in Assam. The myriad/individual peasant proprietors lack the ability of farm organisation and management at their own, because of farm-size disability and capital deficiency. The Government could not help them in this regard throughout the long period of planning efforts.

11.5 TECHNOLOGY

Technology is a principal contributor to economic growth and development. It should be noted that it is not merely technology, but a positive change in it which is more important, because traditional technology runs out of time, stagnating or even reversing progress. The traditional technology must, therefore, be transformed or replaced by a new technology in order to induce dynamism in the economic fabric. Technological changes may lead to changes in techniques, but some of the changes in techniques may be entirely due to the changes in the relative prices of inputs.20

Technological change is defined here as the use of modern inputs such as fertilisers, HYV seeds, insecticides and pesticides, tractors, irrigation pump-sets, threshers and harvester combines, etc.

Full utilization of the potential of the soils of Assam cannot be achieved only by human and animal power with traditional farming practices. Technological change with greater use of modern inputs and lesser use of traditional inputs is necessary for increasing productivity per unit area, intensification of agriculture, change of cropping pattern, re-adjustment of food and cash crop hectareages, and improvement in the quality of agricultural products. Introduction of new techniques or 'technification' embodies both (i) Biological - Chemical (BC), and (ii) Mechanical techniques which have been employed in the so-called Green Revolution of India.

The highly developed countries have been able to increase their agricultural production manifold by the application of BC and mechanical techniques within a very short time. But in Assam, no significant progress has been made in respect of farm production due to the poor level of technification everywhere. The situation prevailing in the state with regard to technification may be seen from the following passages.

**Biological - Chemical (BC) Techniques**

Use of these yield-increasing techniques can bring miraculous results in the field of agriculture, if irrigation is provided simultaneously. Since the BC inputs are divisible, they are size-neutral and, therefore, not only the big farmers, but
also the small peasants may apply such inputs, if credit facilities
are provided to them. Not only the mass illiteracy, poverty, lack
of adequate transport facilities, and extension services have been
resisting the innovation in the BC techniques in Assam, but also
the insufficient supply of these is a major constraint.

High Yielding Varieties of Seeds. The Green Revolution in Haryana
and Punjab is essentially the outcome of the extensive use of HYV
seeds, particularly those of wheat, rice and maize. Such a techno-
logical break-through is possible there, because of the provision
of assured water supply, and, mainly because of the emergence of
the big capitalist farmers backed by a strong political-bureaucratic
 nexus. But Assam is deprived of all such advantages.

Nor is there a class of capitalist farmers nor the govern-
ment's initiative, assured water supply and adequate supply of
modern inputs. However, in a very feeble way, steps were taken
by the State Government to introduce both locally developed
seeds as well as HYV seeds developed by the all-India Agricul-
tural Research Institute. Among the HYV crops, HYV of rice
becomes popular among the peasants of Assam. HYV of rice such
as IR - 8, IR - 1, 'Maneshar Sali' (locally developed), 'Pusa'
and 'Jaya' are now grown in the state. HYV wheat and hybrid
maize are also included in the programme of introduction of
improved seeds. The programme of HYV was introduced for the first time in the state only in 1966-67. The achievement of the area under HYV crops from 1966-67 onwards is shown in table 11.12.

**Table 11.12**

**AREA UNDER HYV CROPS IN ASSAM (in hectare)**

<table>
<thead>
<tr>
<th>Crop</th>
<th>1966-67</th>
<th>1968-69</th>
<th>1971-72</th>
<th>1975-76</th>
<th>Percentage to the total cropped area of the state (in 1975-76)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy</td>
<td>3,667</td>
<td>60,108</td>
<td>200,000</td>
<td>287,598</td>
<td>9.62</td>
</tr>
<tr>
<td>Wheat</td>
<td>81</td>
<td>4,327</td>
<td>39,580</td>
<td>48,494</td>
<td>1.62</td>
</tr>
<tr>
<td>Maize</td>
<td>2,218</td>
<td>2,596</td>
<td>11,635</td>
<td>18,891</td>
<td>0.63</td>
</tr>
</tbody>
</table>

(Source - Unpublished data collected from Dept. of Agriculture, Govt. of Assam).

Table 11.12 shows that the hectares under wheat and maize are very much insignificant in comparison to the total cropped area of the state. Only the area under HYV paddy is somewhat significant. The spatial variation in the distribution of HYV paddy hectares is presented in table 11.13.

In respect of area under HYV paddy, Kamrup, Nagaon, Darrang, Goalpara, Sibsagar, and Haiblu are important. The HYV paddy has been adopted mostly by the immigrant Muslim peasants in the former four districts. The location of the Assam Agricultural University at Jorhat and a relatively high rural literacy
in the Sibsagar district facilitate the diffusion of this type of innovation in that district. The introduction of the Intensive Agricultural District Programme (IADP) in Cachar helps the application of HYV paddy seeds at the Government's subsidy and credit facility extended to the adopters. But only a minor section of the peasants of Cachar are covered under this programme.
Among the HYV paddy, 'Monohar Sali' is most popular among the peasants in Assam. This variety accounts for 67 per cent of the total hectareage under all HYV paddy grown in Assam. The areas occupied by the dwarf 'Sali', 'Ahu', and 'Boro' are 18, 11 and 4 per cent respectively.

During the Fourth Plan period, distribution of all kinds of seeds in Assam through the O.D. Block agencies did not exceed 11,000 tonnes for non-oilseeds and 300 tonnes for oilseeds. The figures obtained from 120 reporting Blocks are given as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Improved non-oilseeds</th>
<th>Improved oilseeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968-69</td>
<td>3,366</td>
<td>202</td>
</tr>
<tr>
<td>1969-70</td>
<td>5,045</td>
<td>147</td>
</tr>
<tr>
<td>1970-71</td>
<td>10,604</td>
<td>289</td>
</tr>
</tbody>
</table>

Rabi Production Campaign Guide (1974-75) for Assam laid down a total requirement of seed of wheat at 7,000 tonnes, summer paddy at 450 tonnes, pulses at 786 tonnes and mustard at 250 tonnes. But the Assam Seed Corporation could not supply improved varieties of seeds of pulses and mustard and, therefore, the peasants were advised to use locally available seeds. Out of the total requirement: of wheat seed ('Sonalika' variety), only 4,000 tonnes were distributed. In 1975-76, only 412.6 tonnes of HYV paddy seed and 1970.8 tonnes of wheat seed were distributed throughout the state. From all these facts, it is clearly

observed that the HYV programme in Assam has not become successful, because of inadequate supply of improved seeds, lack of package programme with all other supporting inputs and lack of demand from the illiterate peasants. Under such a situation, the peasants of Assam still have to depend on the poor varieties of seeds either collected from their own crops or purchased at the free markets. The spread of the HYV seeds is extremely limited both in terms of areas and regions, and crops raised. The meagre areas covered so far by the HYV crops are also not supported everywhere by the requisite inputs and infrastructure. So the expected result in respect of increase in yield rates has not been achieved. Under optimal technical conditions, the new varieties can grow successfully, but they are land-lord biased and tend to exclude the poor peasants from the benefits of technical change.

Fertilizer. Mere introduction of HYV seeds cannot increase the yield, if it is not associated with the use of fertilizers. The maximum additional yield on account of using manures and fertilizers has been estimated to be 25 to 35 per cent and even more in case of irrigated crops.

Peasant agriculture in Assam is characterised by low consumption of manures and fertilizers. The only common manure used is the cow-dung, but even its use is sporadic. Compost and

22 Griffin, K., op.cit, pp. 78-82
23 Handbook of Agriculture, ICAR, p. 82.
green manuring are used only to a little extent. Compared with some other states of India, consumption of chemical fertilizers per hectare in Assam which was only 0.62 kg during 1974-75 is extremely low as against 53.28 kg in Punjab, 35.15 kg in Tamil Nadu, 26.67 kg in Andhra Pradesh, 15.94 kg in Haryana, 16.19 kg in West Bengal and 16.64 kg in the country as a whole. In 1975-76, it increased to only 1.09 kg per hectare in Assam (Table 11.14).

Table 11.14

<table>
<thead>
<tr>
<th>District</th>
<th>Total NPK (in tonnes)</th>
<th>Kg per hectare cropland</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Goalpara</td>
<td>271.6</td>
<td>0.54</td>
</tr>
<tr>
<td>Karur</td>
<td>228.7</td>
<td>0.35</td>
</tr>
<tr>
<td>Nowgong</td>
<td>247.4</td>
<td>0.65</td>
</tr>
<tr>
<td>Darrang</td>
<td>419.3</td>
<td>0.94</td>
</tr>
<tr>
<td>Sibsagar</td>
<td>692.3</td>
<td>1.79</td>
</tr>
<tr>
<td>Lakhimpur</td>
<td>135.8</td>
<td>0.80</td>
</tr>
<tr>
<td>Nibughar</td>
<td>672.5</td>
<td>3.09</td>
</tr>
<tr>
<td>Cachar</td>
<td>622.2</td>
<td>2.18</td>
</tr>
<tr>
<td>K.A. &amp; N.G.Hills</td>
<td>190.6</td>
<td>1.26</td>
</tr>
<tr>
<td>Assam</td>
<td>3,480.2</td>
<td>1.09</td>
</tr>
</tbody>
</table>

N.B.: NPK stands for Nitrogen, Phosphorus and Potash.
(Source - Column (2) is derived from Basic Agricultural Statistics, 1975-76, Directorate of Agriculture, Govt. of Assam, p. 117 and column (3) is computed).

24 Mahanta, K.C., op.cit., p. 114
Consumption of fertiliser is higher in those districts, where there is tea plantation. It may, therefore, be assumed that the peasant agriculture in Assam is a very poor user of chemical fertilisers. Lack of assured irrigation during the rabi season, flooding and large scale water-logging during the kharif season are some of the recognised constraints to fertiliser use. But even in areas not subjected to these calamities, fertiliser use is not encouraging. Inadequate supply of credit to the poor peasants and improper distribution system are some of the other bottlenecks. It is disappointing to note that even the limited amount of bank credit, that is available to a small section of the peasantry, could not be utilised for the purchase of fertiliser, as this input could not be supplied to the users at the appropriate time of its requirement in the field. Inadequate storage facilities and unremunerative profit margin for retail fertiliser business, aggravate the position of availability of fertilisers at consuming points.

Plant Protection. Plant protection is regarded as one of the essential factors for increasing agricultural production. It is a common experience that pests and diseases can seriously damage crops if adequate preventive and curative measures are not taken in appropriate time. It has been proved by the Agronomists that much of the crop losses (10 to 30 per cent) inflicted by a large variety of pests and weeds can be reduced by timely and adequate
plant protection measures.

Along with the rise in area under HYV, incidence of diseases and pests is also said to increase. It is disappointing to know that no systematic survey of the diseases and pests in Assam has so far been made. Since the climate of Assam is very much humid, the chances of incidence of pests and diseases in HYV crops are greater in comparison to the semi-arid regions like Haryana and Punjab. Even the local varieties which were adjusted ecologically would not remain immune from such hazards.

Plant protection is a highly capital-intensive as well as labour-intensive measure. For successful operation of this measure, a well-knit organisation from the research centres to the fields is essential with adequate field staff, sufficient number of machines and transport vans and adequate quantity of pesticides and insecticides.

Data on the consumption of pesticides and insecticides in Assam are not available in the official records except that the total consumption of pesticides during 1975-76 was shown to be 153.92 metric tonnes by the Directorate of Agriculture, Government of Assam. Lack of adequate plant protection measures in Assam is an indication that this state has not yet trodden on the path of agricultural innovation.

**Mechanical Techniques**

Mechanical techniques are labour-saving, capital-intensive
and land-augmenting. There is, therefore, a doubt that mechanisation of agriculture accompanies the displacement of both human and animal labour. That is why it is generally not prescribed for a region of high population density with surplus agricultural workers. But the economic history of all advanced countries shows that mechanisation of agriculture has been successful in achieving manifold benefits. A large proportion of workers engaged in agriculture can be taken away from land through mechanisation without any adverse effect on its production and thus the efficiency of farm worker and output per capita can be increased to a great extent. The problem of labour displacement should not stand in the way of agricultural mechanisation. Such a problem should be solved through proper man-power planning.

In Assam, the small-sized subsistent farming and limited economic resources inhibit the use of modern implements. The use of primitive agricultural tools, the wooden plough in particular, is one of the manifold inefficiencies of agriculture in the state. The distribution of the density of wooden plough per 100 hectares of cultivated area in different districts of Assam is shown in Fig. 11.9. There were altogether 1,385,922 wooden ploughs and only 18,183 iron ploughs in the state in 1972. Sibsagar recorded the highest number/wooden plough accounting for a density of 97.07 ploughs per 100 hectares of cultivated area, while N.-C. Hills recorded the lowest number accounting for
a density of only 12.23.Though Kamrup possessed the second highest number of wooden ploughs, the density was comparatively low (38.51 only). But, in respect of iron ploughs, highest number was recorded in Kamrup followed by Cachar and Darrang, while N.C.Hills recorded the lowest number. The iron plough density was highest in Cachar (1.23) followed by Kamrup (1.06) and it was lowest in N.C.Hills (0.05)\(^2\).

According to the Livestock Census, Assam, 1972, other agricultural implements used in the state were blade harrow, wet land paddler, earth leveller, seed drillers and sugarcane crusher, numbering 90227, 67701, 398649, 1090 and 6051 respectively. Besides, there were 4,693 sprayers and dusters. There were 552 irrigation pump sets in the state according to the Livestock Census, Assam, 1972. Of these, 473 were oil-engine pump sets and 79 were electrical pump sets. Among the districts of the state, Darrang recorded the highest number of pump sets (111), followed by Kamrup (106), Dibrugarh (100), Newgong (82), Goalpara (76) and Cachar (75). Not a single pump set was recorded in each of the Sibsagar, Lakhimpur, K.A., and N.C.Hills districts.

Use of tractors is also negligible in Assam. Only a few rich peasants had taken the advantages of tractors, especially during the dry season for growing rabi crops. The number of both the Government supplied and privately owned tractors in 1972 was 683. Of these, 107 were Crawlers, 54 Hand Tractors or Power tillers\(^\text{12}\) Livestock Census, Assam, ibid, pp. 154-171.
and 522 Four-Wheeled Tractors. About 16 per cent of these machineries were of the Government and the rest were privately-owned. The Livestock Census, Assam, 1972, manifests that tractorisation is highest in Darrang followed by Dibrugarh and Sibsagar. In the hills districts, it is quite natural that tractors cannot be easily used. But the most distressing is the condition in Kamrup, even though this district covers the largest cultivated area and the largest number of peasants among the districts of the state. Labour-intensive iron plough rather than labour-saving, capital-intensive tractors seems to be more popular in Kamrup. Darrang ranks first in respect of technological innovation in relative sense only, among the districts of Assam, since this district has used the largest number of tractors and covered the largest irrigated area. In comparison to other advanced states of India, mechanisation of agriculture is very much insignificant in Assam as a whole.