CHAPTER TWELVE

SUMMARY OF FINDINGS, CONCLUSIONS AND SUGGESTIONS.

XII.1 Rate and pattern of agricultural growth in Assam.

During the twenty five years from 1960-61 to 1984-85, the period for which the rate and pattern of agricultural growth in Assam has been analysed in this study, agricultural growth in general proceeded at a slower rate in Assam than at the national or the all-India level. The estimate of the average annual compounded growth rate of agricultural production in the state for the entire period works out to be 2.17\%, which is well below the same growth rate for the country as a whole for a similar period (about 3\% per annum). This meagre growth rate appears to be even more inadequate in view of the fact that the rate of growth of population in the state for this period was much higher (about 3\% per annum compounded) than that of the entire country (about 2.2\% per annum compounded).

Throughout this period, the growth in agricultural productivity in the state was very weak. Whatever little growth was achieved in agricultural production, thus came mainly from expansion of area under cultivation. As is well known, the growth in the area under cultivation has slowed down considerably at the all-India level since the middle of 1960s and it is the growth of productivity or yields which has been mainly responsible for sustaining the growth of agricultural production in the country ever since. However,
there are no indications of this tendency extending to agriculture in Assam too. In Assam, by contrast, the rate of growth of area under cultivation appears to have registered a slight increase in the period 1969-70 to 1984-85 from its level during 1960-61 to 1968-69. Overall agricultural productivity growth rate in the entire period 1960-61 to 1984-85 remained well below 1% per annum with no sign of significant acceleration in the growth in the later period of 1969-70 to 1984-85.

In contrast to the all-India pattern, rate of growth of production of non-foodgrains in Assam was higher than that of foodgrains during 1969-70 to 1984-85. For the country as a whole, since the technological breakthrough in foodgrain production of mid-1960s, production of foodgrains has come to dominate the agricultural growth and the growth in the production of non-foodgrains has been generally lagging behind that of foodgrains. But in Assam, the growth rates of area, and production of non-foodgrains have been significantly higher than those of foodgrains since the late 1960s.

Barring a few crops, such as jute and mesta, crop productivity in Assam in general has been much below the all-India productivity levels in the recent years. Worse still, the gaps in the all-India yield rates and the yield rates in Assam had a tendency to widen for both rice and wheat over the period 1973-74 to 1984-85, for which a comparison has been done in this study.
XII.2 Impact of the new farm technology on agriculture in Assam

According to the statistics collected from the Directorate of Agriculture and the Directorate of Economics and Statistics of the Governments of Assam, the area under high yielding varieties in Assam has been steadily rising since their introduction in the late 1960s in the state. However, this increase does not seem to have been able to contribute much towards enhancing crop productivity in the state. For instance, despite the increase in the area under H.Y.V. rice in the state from 99.85 thousand hectares in 1969-70 to 950 thousand hectares in 1985-85, the compounded growth rate of yields of rice in the state during the same period works out to be only 0.76% per annum. Moreover, the steady increase in the area under high yielding rice varieties notwithstanding, the diffusion of these varieties in Assam has lagged behind their spread in the country as a whole. By 1984-85 over 55% of the total rice acreage of the country was brought under high yielding varieties, whereas in Assam only 40.86% of the total rice acreage was under high yielding varieties in the year 1984-85.

Over the decade from 1975 to 1985, the annual fertilizer consumption in the agriculture sector of Assam had gone up by 200%. But despite this phenomenal increase, fertilizer used per hectare in the state (3.68 Kg/s) was still very low in 1984-85. It was in fact less than even one-tenth of the all-India average fertilizer consumption per...
hectare (46.38 kg.s). In view of the extremely low level of fertilizer application per hectare, the general low crop productivity in the state is not surprising.

Irrigation facilities in the state are also grossly underdeveloped. In 1984-85, irrigation potentials available in the state amounted to only 10% of total cropped area of the state. As a result of various measures, the total irrigation potentials available in the state nearly reached the 500 thousand hectares mark recently. Unfortunately about a half of even this limited irrigation potentials available remained unutilised in the four years from 1984-85 to 1987-88.

The slow pace of agricultural growth, the low yield rates of crops, very limited effectiveness of H.Y.V.s in improving agricultural productivity, the small amount of fertilizer consumption per hectare and merely a marginal role of irrigation in the state agriculture sector are all indicative of the continued state of backwardness of agriculture in Assam. The new agricultural strategy of the late 1960s, with its understandable early concentration in selected regions of the country, has yet to have its effective operation in Assam even in the mid-1980s.

XII.3 Findings of the field study.

(1) The field study carried out in four Agricultural Extension Officer circles in the Brahmaputra Valley of Assam during the winter of 1987-88, reveals that some positive trends are already well underway in the farm sector of the state. The H.Y.V. seeds, whose use in Assam started picking
up slowly around the mid-1970s, have now been adopted widely by the farming community of the state. Nearly 80% of the farm households covered in the field survey were found to be using the high yielding varieties.

(2) Although the use of H.Y.V. seeds has by now been widely adopted by farmers in the state, the effective utilisation of the potentials of these varieties has in general remained fairly limited so far. First of all, farmers in general have not been able to extend the use of these varieties beyond a limited proportion of their crop acreage. Although about 80% of the sample farmers were using H.Y.V.s their combined area under high yielding rice varieties, for example, comprised only about a quarter of their combined rice acreage. Secondly, most of the farmers using H.Y.V.s have not been able to support the use of these varieties by adequate application of complementary inputs such as fertilizers. About 38% of the 160 sample farmers cultivating high yielding rice varieties used chemical fertilizers with these varieties at the practically negligible rate of less than 10 kilograms per hectare. (Some of them in fact used no fertilizers at all.) Only 18 farmers, i.e. 11% of those cultivating high yielding rice varieties, used chemical fertilizers at the generally recommended dose of 80 kilograms or more per hectare on their H.Y.V. rice crop.

Awareness among farmers of the necessity of soil testing for better farming has been found to be lacking in general.
The practice of line sowing has been found to be less widespread among farmers than the use of H.Y.V.s. Moreover, farmers adopting the practice of line sowing have in general restricted its use to their H.Y.V. rice crop only, although the use could be easily extended to other crops as well.

(3) Among the various media of transmitting agricultural innovations to farmers, the agricultural extension service has been found to be most effective. About 50% of the sample farmers using H.Y.V.s were induced to adopt these varieties by their contacts with the personnel of the agricultural extension service network of the state government. Radio broadcasts on better farming methods seem to have contributed very little to the spread of the new farm technology among farmers in the state.

(4) Adoption of H.Y.V.s does not seem to have induced large scale mechanisation of farm operations in the state. Combine harvesters have not been found to be in use anywhere in the four areas of our field study. Mechanisation of ploughing has also not made any significant inroads in the sample farms, except of course in the Joysagar circle. In Joysagar, farmers have gone in significantly for mechanised ploughing while they lag behind the farmers in the other three circles in adoption of H.Y.V.s. The bias towards mechanisation in the pattern of changes in farming techniques in Joysagar can be attributed to the fact that farm labour is comparatively less abundant there than in the other three circles.
(5) Significant variation has been observed in the patterns of use of high yielding rice varieties by sample farmers in the different rice growing seasons of the state.

In the wet ‘sali’ season the use of high yielding rice varieties has been found to be fairly widespread among farmers and by no means confined to irrigated farms only. In contrast, in the comparatively dry ‘ahu’ season, the use of these varieties has been found to be constrained largely by availability of irrigation.

The new rice varieties which have gained wide popularity in the ‘sali’ season are ‘Mahsuri’ and ‘Pankaj’, both of which have a comparatively long duration of 140 to 150 days. The short duration modern rice varieties have not been found very much in use in the ‘sali’ season. One important reason for this is the fact that they become ready for harvest a bit too early, even before the end of the rainy season, thereby causing practical problems for harvesting and processing. In the ‘ahu’ season of course the short duration varieties of ‘Pusa’, ‘Jaya’, ‘Cauvery’, ... etc. were preferred by sample farmers to ‘Mahsuri’ and ‘Pankaj’. In the ‘ahu’ season the short duration varieties enjoy the advantage of being ready for harvest before the onset of heavy monsoon rains besides releasing land in time for the kharif crop to follow.

In quite a few instances in our field survey farmers have been found to be cultivating ‘Mahsuri’ rice during the ‘sali’ season using very little or no chemical fertilizers at
all. In such cases the variety gives yields which are not very different from those of local traditional varieties. Nevertheless, farmers find it convenient to divide their 'sali' acrâge between 'Mahsuri' and traditional local varieties instead of planting the entire acrâge with the latter only. One main factor behind this practice is that the 'Mahsuri' rice becomes ready for harvest about a month ahead of the usual local varieties. To the small farmers, cultivation of 'Mahsuri' therefore means an early relief from the usual tight economic conditions towards the latter half of the 'sali' season. Moreover division of the 'sali' acrâge between 'Mahsuri' and the traditional local varieties also enables farmers to space the hectic operation of harvesting the 'sali' crop over a longer period of time, which in turn creates considerable managerial advantage for the medium and large farms. Moreover, the comparatively early harvesting time of 'Mahsuri' also releases land and other factors just in time for growing various 'rabi' crops.

(6) Farm size and the literacy standard of the farm household do not figure among the factors which have been found to have significant bearing on a farmer's decision as to how much of his rice acrâge should be planted with high yielding varieties.

Availability of irrigation and close contact with the agricultural extension service network have been identified as the two major factors which help farmers greatly in using H.Y.V.s extensively.
A farmer's ability to increase the proportion of area under H.Y.V.s in his total rice acreage is however impaired to the extent that his cultivable area happens to be very low-lying and prone to flooding and waterlogging. New improved varieties, which can thrive in such conditions are yet to be developed by agricultural scientists.

(7) There is no indication of larger farmers tending to use fertilizers at higher doses per unit of area under H.Y.V.s. But small farmers seem to be more numerous among those who used very little or no fertilizers with H.Y.V.s.

Strictly speaking irrigation is neither a necessary nor a sufficient condition for use of chemical fertilizers with H.Y.V.s. But in general availability of irrigation seems to create strong favourable condition for using the H.Y.V. seed-fertilizer package more effectively.

As elsewhere, rice farmers in Assam too tend to use fertilizers with H.Y.V.s at higher dose in the dry season than in the wet season. The fact that the cultivation of H.Y.V.s in the dry 'ahu' season is done mostly under irrigated conditions, makes the conditions ideal for use of fertilizers substantially.

Given other factors, contacts with the personnels of agricultural extension service can motivate farmers to practice the H.Y.V. seed-fertilizer package more rigorously. But on their own, such contacts will be hardly adequate to induce farmers to use fertilizers substantially.
Over and above the factor already mentioned, the financial resource position of the farm family also appears to be an important factor influencing a farmer's ability to adopt the new farm technology package and use it extensively. A substantial number of the farmers interviewed in the field survey reported that inability to finance was their principal handicap in adopting / extending the use of the new farm technology. Their number in the entire sample was next only to those who cited non-availability of irrigation as the principal handicap.

(9) Although sample farmers in general had not been able to use the new farm technology very extensively and / or effectively, it is heartening to note that the number of farmers who held negative or indifferent attitude towards the new technology was very small in the whole sample. Such farmers comprised only a meagre 8% of the size of the sample.

XII.4 The final conclusions of the study.

The study clearly demonstrates that the farmers in Assam in general are not averse to changes and that on the contrary, they are willing to innovate and experiment. The field survey has shown that farmers by and large have already adopted the use of the new varieties of seeds. That the overall agricultural productivity in the state has not improved very much despite the widespread adoption of H.Y.V.s by farmers here, is because of the fact that the farmers adopting these varieties in general have not been able to use
them very extensively and effectively, owing of course to a number of constraints operating upon them.

The findings of the study point mainly to the following four factors as the principal deterrents to the process of technological transformation of agriculture in Assam.

1. The limited suitability of the new rice varieties to the environmental conditions of the main rice growing season of the state.
2. The limited availability of developed irrigation facilities in the state.
3. The loopholes in the present system of agricultural extension service.
4. Inadequate participation of institutions of rural credit in the process of transfer of technology in the farm sector.

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 for paddy fields to get waterlogged and flooded. Improved rice varieties which can withstand such conditions are yet to be evolved by agricultural scientists. Thus farmers in the state can at best 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 farmers' decisions regarding the proportion of crop acreage to be sown with H.Y.V.s and the quantity of chemical
fertilizers to be used per unit of area under H.Y.V.s. 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 of all, it has restricted farmers ability to extend the use of H.Y.V. seeds particularly in the dry seasons. Secondly, having to cultivate H.Y.V.s mostly under unirrigated conditions, farmers in general have not been able to utilise effectively the potentialities of these varieties by adequate application of soil nutrients with them.

In the process of transfer of technology in agriculture the role of the extension service is very crucial. The field study has yet again established that the agricultural extension service is the most powerful of the various media for carrying agricultural innovations to farmers' fields. Contacts with the personnels of agricultural extension service (including those of the Agricultural University) have been found to be a definite advantage for a farmer in adopting H.Y.V.s and utilising their potentials effectively. But unfortunately, as the findings of the field study indicate, agricultural 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' fields in Assam.

Going by the instances of the four areas of our field
survey, the network of financial institutions for agricultural and rural development appears to be reasonably developed at least in some parts of the state. In all the four A.E.O. circles in which the field survey was carried out, a number of branches of these institutions have been found to be operating. The financial institutions seem to have contributed significantly towards fixed capital investments for better farming. (It may be recalled that installation of irrigation pumpsets of sample farmers were generally financed by the institutions of rural credit through the Assam State Minor Irrigation Development Corporation Limited.) However, their performance in the area of providing short term agricultural credit or crop loans, leaves much to be desired. Although a substantial number of farmers reported 'inability to finance' as their main handicap in adopting / extending the use of the new farm technology, none of the 205 sample farmers were in the receipt of short term crop loans from the institutions of rural credit. This clearly indicates that unlike in some other parts of the country, the institutions of rural credit in Assam are yet to be actively involved in the process of transfer of technology in the farm sector.

At this point, questions may be raised about the adequacy of the other aspects of agricultural infrastructure such as the system of distribution and sale of farm inputs, marketing channels and storage facilities for farm outputs ... etc, in the context of technological transformation of
agriculture in the state. The field study found no evidence of shortcomings in these areas posing any serious problem for adoption and use of the new technology for farmers. Only a small number of farmers, comprising less than 5% of the sample size, reported non-availability of inputs in time as a major problem in using new farm technology more extensively.

In short thus, the conclusions emerging from the study vindicate our hypothesis that the farmers in Assam are not averse to changes and are in fact, willing to adopt innovations, and that the inadequacies of agricultural infrastructures of irrigation, extension service and rural credit are mainly responsible for the slow diffusion of the new farm technology in the state. The conclusions also emphasise the need for further agricultural research aimed at evolving improved varieties which would be more adaptable to the environmental conditions of the state.

XII.5 Suggestions.

The conclusions of the study suggest that to achieve a complete technological transformation of agriculture in Assam, measures would be necessary mainly in two directions, namely -

(1) to improve upon the present package of the new farm technology so as to widen its scope and adaptability for the diverse environmental conditions of the different areas and seasons of the state,

(2) to strengthen various agricultural infrastructures so as
to enable farmers to utilise the potentialities of existing technological know-how to the maximum possible extent.

The task of improving upon the existing package of the new farm technology calls for co-ordinated research in various branches of agricultural science. Some such research is already underway in research stations inside and outside the state. Keeping in view the limitations of the known H.Y.V.s to the waterlogged 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. Moreover, agricultural research in general today cannot possibly afford to ignore the broader questions of food safety, ecological balance and environmental cleanliness, which are reported to have been endangered by the high 'inorganic fertilizers and toxic pesticides'-intensiveness of the H.Y.V. seed based technology. 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 agro-chemicals, development of self decomposing pesticides and engineering of biological pest control methods.

Since the outcome of any scientific research is uncertain with breakthroughs arriving at irregular intervals, the best course of action available for the present is to make the most of the available technological knowhow. To do the same in the agriculture sector of Assam, it would be 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.

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. A blueprint for development of irrigation facilities in the state cannot be prepared without a comprehensive study. Available statistics and literature on the subject enable 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. Apart from the usual problems of large initial investment, long gestation period and the necessity to construct elaborate network of distributory field channels, surface flow irrigation systems based on river dams have several limitations in Assam. First of all, due to highly permeable character of the soil in most parts of the state, the loss due to seepage in the process of distribution may be very substantial. Secondly, maintenance of the distributory channels during the rainy seasons as also keeping them clear from aquatic weeds may become a serious problem. In fact, the possibility of such irrigation systems aggravating the problem of floods and waterlogging 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. Ground water based well irrigation systems are not only cheap but are also within easy reach of an average farmer. The small scale nature of a shallow tubewell based irrigation system makes it ideal for most farms in Assam, where the average size of operational holding is comparatively smaller than in most other states of India.

Geological surveys have found that there is tremendous scope for developing ground water based irrigation systems in most parts of the state except the Barak Valley. To summarise these findings we quote from the work of M. M. Das. "Assam is comprised of three hydro-geological units, viz, the Brahmaputra Valley, the Central Assam Range (Karbi Anglong and North Cachar Hills districts) and the Barak Valley.

The entire Brahmaputra 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 metres below the surface. Development of irrigation from ground water through shallow and deep tubewells is feasible in the entire Brahmaputra Valley.

Prospect of ground water irrigation in the hilly region (i.e. the Central Assam Range) is generally limited
small inter-mountain valleys. In the limestone terrains such as the Umrang basin of Karbi Anglong, the sinkholes of various sizes, if interconnected, are capable of yielding large quantities of ground water.

The sediments comprising the water bearing horizons of the Barak Valley down to 50 metres are predominantly clayey and do not support good tubewells. It is therefore considered that tubewells in this region can not be successful."

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 causiously with an eye towards conservation and replenishment of the natural water resource of the state.

In order to expedite the process of transfer of technology, it would also 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. Our experiences in the field survey indicate that the existing system of Village Level Extension Workers (V.L.E.W. in short) communicating information to the farming community through the selected groups of contact farmers, has not worked satisfactorily everywhere. Technically there is no guarantee in the system that information conveyed by V.L.E.W.s to contact farmers get communicated to all farmers in the locality. Increasing the number of V.L.E.W.s in each circle and at the same time
raising the number of contact farmers in each V.L.E.W. 'eleka' or area may help to cover the loopholes in the extension service network to some extent. While the increase in the number of contact farmers would bring more farmers to direct contact with the extension service network, the increase in the number of V.L.E.W.s would help to make the service more intensive. A system of rotation of the batch of contact farmers in each village after every couple of years or so, might also help to bring more and more farmers closer to the agricultural extension service over time.

In one instance in the field survey it was found that the V.L.E.W. had not received proper preparatory training for his job. Unless the V.L.E.W.s have had adequate training and are qualified for the kind of job they are to handle, the quality of the extension service cannot be expected to be of any reasonable standard. For the sake of the quality of the extension service, it is imperative to ensure that a V.L.E.W. 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 extension officers of course cannot be said to be quite conducive for highly efficient and effective discharge of their duties. An extension 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 same time make them more accountable for the state of agriculture in their respective areas.

For rapid diffusion of the new technology among all section of farmers in the state, the institutions of rural credit are also required to step up their active participation in providing short time agricultural credit. In this context the usual argument of financial institutions that such loans involve high risks of default, cannot be dismissed lightly. But if the financial institutions can device some procedure to ensure that the loans are used for the purpose for which they are sanctioned, and if the credit linked crop insurance scheme (introduced in the country in the mid-1980s) can be extended to cover more areas of the state, risks of default of crop loans should not be particularly higher than those of loans advanced for other purposes.

In order to take a more active part in the various programmes of rural development, including that of transfer of agricultural technology, it is very important for the financial institutions operating in the villages to simplify procedures of dealing with people and to cut down formalities to the unavoidable minimum. In many instances in our field study, farmers, despite being in need of financial support for better farming, were found to be reluctant and apprehensive about approaching financial institutions for credit, as issue of institutional credit involved numerous
formalities. Unless the financial institutions operating in the village sector reach out to the masses and inspire the growth of banking habits among all sections of village people, they will be serving only the rural elites of the large and medium farmers, betraying thereby, the very purpose for which these institutions were originally established.

In the remaining aspects of agricultural infrastructure, such as the system of distribution and sale of farm inputs, marketing and storage of farm products, etc, the existing state of affairs does not seem to be causing any serious problem for farmers in adoption and use of the new technology. This however does not warrant any complacency with regard to these areas of farm infrastructure. Distribution system of the modern farm inputs and implements, and storage and marketing facilities for farm outputs should be planned and organised well in advance to cope with the future increase in demand for these services in the process of growth and development of the agriculture sector of the state.

To inspire more enthusiastic participation of farmers in various schemes and programmes of agricultural development in the state, the need for some organisation among farmers at the village level has been emphasised at some quarters. P.C.Göswami, for instance, suggests the setting up of a 'Field Management Committee' for each big agricultural field for better co-ordination among farmers operating in it. Such
committees, he insists, 'should have representatives from all section of farmers' and 'can suggest through mutual discussions cropping patterns, crop rotation, improved farm practices, new inputs and new crops for both 'rabi' and 'kharif' seasons.' Such an organisation of farmers, functioning truly to the spirit of betterment of all farmers in the village, can undoubtedly add momentum to the process of technological transformation of agriculture. Important thing therefore is not merely to set up such organisations but also to see that they are not reduced to another kind of instruments for channelising the benefits of development schemes to the influential section of the village society only.

Reference :-

(1) M.M.Das, (1980), 'Structural Analysis of Peasant Agriculture in Assam', Ph.D thesis submitted to Gauhati University. (subsequently published in 1984 by Inter-India publications), chapter XII section 12.2

(2) P.C.Goswami, (1989), 'Modernising Assam's Agriculture' in 'Agriculture in Assam' (ed) P.C.Goswami, Assam Institute of Development Studies, Guwahati.