

AGRICULTURAL DEVELOPMENT IN NORTH-EAST INDIA

Constraints and Prospects

Edited by
K. ALAM



AGRICULTURAL DEVELOPMENT IN NORTH-EAST INDIA CONSTRAINTS AND PROSPECTS

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PREFACE

Notwithstanding agriculture, the backbone of the region's economy, having attracted the largest attention of planners in all the Five Year Plans, why does the region fail to achieve the expected goal in the agricultural sector even after four decades of planning, still remains a fundamental question.

The North-East India Council for Social Science Research, Shillong organised a two-day seminar on 'Constraints of Agricultural Development in North-East India' during 2-3 July 1990 in Shillong.

The papers take an unhappy note of the land system and land-man ratio. While in the plains ejection of tenants from land could not yet be arrested inspite of several enactments of land reform measures, leading thereby, to increasing number of landlessness coupled with continuous fragmentation of land, the ownership pattern in the hill areas remains the greatest stumbling block to investment in land and improvement efforts of land productivity. Without a proper land survey and conferment of private ownership rights, no amount of effort can bring about agricultural development. A strong political will is necessary to bring about a breakthrough in this respect.

The exploitative nature of existing market situation largely prevalent today is characterised by multiplicity of weights and measures, adulteration, inadequate storage facility, lack of feeder roads, absence of grading of products, lack of market intelligence and market infrastructure. This has to be removed by establishing regulated market by the government at various central places in the rural areas.

The need for revamping the agricultural credit structure is all the more necessary in view of higher interest rates charged by the primary agricultural credit societies which also suffer from non-refund of loans, inefficient management and misappropriation of funds in many cases. The informational constraint relating to knowledge of the farmer about schemes of financial assistance has to be removed. Otherwise, the evil

forces of non-institutional financing and related exploitation cannot be arrested.

Controlling flood is a necessity. The states of the region suffer every year several waves of flood. Though flood cannot be completely avoided, the region must learn to live with them by devising means to safeguard the agricultural fields from inundation.

Together with other extension services, knowledge of farm management is to be imparted to farmers. Establishment of growth centres may help the growers in different aspects of input supply, agro-services, processing of agricultural products, etc. For adoption of new technology, particularly by small and marginal farmers, the role of institutional rural credit will remain crucial.

The planners, administrators and implementing agencies must be careful in introducing a new technology in tribal areas. The socio-climatic, geo-physical and psycho-emotional differences will require different types of technology in different areas. The local users of technology should be consulted and convinced before introduction of an innovation.

The facilities extended to farming community either in the form of subsidy or supply of inputs or in the form of financial assistance and the process of access to these benefits or the result of research work in the field of technology innovation and any new addition to knowledge of farming should find wide publicity through various mass media programmes.

Agricultural development programmes should give due stress on the allied fields like, animal husbandry, live-stock farming, dairy and poultry farming, bee-keeping, etc. together with forestry and fishery. All of them are of immense importance in the field of agricultural development in North-East India.

In order that productivity of land can be improved the seminar discussed the feasibility of implementing what is called Group Farming under which small plots of a contiguous area can be brought under cultivation by a committee which would act like an entrepreneur and would proportionately divide the benefits of production to the owners of the plots under group farming. This would raise per hectare productivity by eliminating wastage of land and introducing mechanised agriculture on large scale. The method may be considered for adoption at the appropriate level.

We take this opportunity to thank North-Eastern Council, Shillong, Indian Council of Social Science Research, New Delhi for

their support to this seminar. We thank also Professor V.S. Mahajan, Professor B. Pakem, Professor P.C. Barua, Dr. B.B. Dutta, Dr. Asok K. Maiti and Dr. S.K. Barpujari who presided over different sessions of the seminar.

We are grateful to Mr. G.S. Bhatia of Deep and Deep Publications, New Delhi for undertaking the publication of this volume.

Shillong

B. DATTA RAY

EDITOR'S NOTE

North-East India is one of the most sensitive regions of the country. But unfortunately the region is the least known to the outside world. North-Eastern region of India consists of seven states—Assam, Meghalaya, Manipur, Mizoram, Nagaland, Arunachal Pradesh and Tripura. Most of these states were carved out of Assam sometime or other during the post-independence period. These north-eastern states are economically very backward in comparison with other states of the Union. As in the case of a backward economy, all the north-eastern states are characterised by the predominance of agricultural sector. Around three-fourths of the population, on the average, depend on agriculture and other primary production activities as their principal means of occupation in the N.E. States. Moreover, the share of agricultural sector in the generation of state income varies between 50 to 55 per cent.

However, notwithstanding its predominance in the regional economy, the agricultural sector is extremely backward within the overall backward economy. Because of the differences in terrain, method of cultivation, geo-physical, agro-climatic and sociological conditions, there is inter-state inequality within the region in respect of agricultural development in general and production and yield of crops in particular. It is needless to say that the economic upliftment of the entire north-eastern region depends, to a large extent, on the achievement of agricultural breakthrough. There is, no doubt, that through the genuine implementation of appropriate measures under a long-term agricultural policy and strategy, the region has the potentialities of achieving a high level of agricultural development commensurate with its native resources and advantages. But in order to achieve that goal, various constraints—structural, institutional, technological and sociological etc. retarding the progress of agricultural development have to be properly identified and appropriate

policy measures have to be formulated and implemented. Now the question is how to approach the problem? There are, no doubt, different ways to address the problem. The academicians belonging to various concerned disciplines can also contribute in the relentless struggle against the deep-rooted agricultural backwardness of the region with their own weapons—an incisive probe and objective analysis of what ails the agriculture of India's north-east and how to combat it effectively. It is exactly in that spirit, the North-East India Council for Social Science Research (NEICSSR), a leading social science organisation of the region with its headquarters at Shillong organised a two-day seminar on July, 2-3, 1990 at Shillong on "The Constraints of Agricultural Development in North-East India". As many as thirty-four scholars belonging to various disciplines presented papers dealing with one or other aspect of the theme in the seminar. These papers relate not only to N.E. region as a whole, but also to individual states of the region.

The present volume is the collection of all these thirty-four papers presented in the seminar. The papers obviously reflect the views of the individual authors who are eminent in their own fields. The theme and area coverage is restricted to what has been presented in the papers. Major portion of the papers related to North-East India as a whole and Assam which happens to be only major state of the region. There are as many as twelve articles dealing with various aspects of the theme covering North-East India as a whole in the volume followed by thirteen articles on Assam, two articles on Arunachal Pradesh, one on Meghalaya, three on Tripura, one each on Mizoram and Nagaland. The articles have been presented in that order in the present volume.

Among the twelve articles dealing with the North-Eastern region, the paper entitled 'Agricultural Development in North-East India with special reference to Settled Agriculture' contributed by P.J. Goswami raises some basic issues regarding the socio-economic constraints of agricultural development in the north-eastern region, which, in his opinion, can be removed, if adequate investment with regard to provision of water and other developmental infrastructure can be made in a phased manner. Durgeswar Bora in his paper 'Constraints of Agricultural Development in the Hilly Regions of N.E. India' discusses in some details the predominance of the age-old shifting cultivation as a form of agricultural practice in the north-eastern hill region. The positive point is that the hill people are not always averse to dynamism in crop production technology. Any technological change will be

acceptable to them, provided it assures them remunerative income. It is voluntary acceptance and not imposition from above which will bring about technological change in hill agriculture. S.K. Agnihotri (*Agricultural Production Constraints in North-East India*) gives a systematic view of the natural, technological and sociological constraints of agricultural production in North-Eastern hill regions and Assam and suggests various policy prescriptions to overcome the situation. 'Agriculture in North-Eastern Region—Potentialities, Problems and Strategies for Development', a paper jointly written by S.N. Goswami, B.K. Sarma and A.N. Choudhury discusses the vast potentialities of agriculture in the region, peculiar constraints in the process of agricultural development and the various strategies to accelerate its pace. Asok Kr. Maiti (*Prospects of Agricultural Development in North-East India*) deals with the various types of constraints—cultural, economic, legal, administrative etc. afflicting the agricultural development in the North-East India. The author pinpoints several ailments resulting in the retrogression in agriculture in the region and also offers a few suggestions as how to exploit the potentialities of development within the different agro-ecosystems in hills and plains of N.E. India. Zahid Hussain (*Constraints in development of Settled Agriculture in the Mountain Eco-System of N.E. India*) analyses in depth the environmental, socio-economic and technological constraints in the development of settled agriculture in the mountain ecosystem of N.E. India and also suggests measures for a better living with sound ecological balance. P.C. Dey in his paper 'Agriculture in the Tribal Dominated States of North-Eastern India—A Simplified Technical Approach' makes an analytic study of the importance, level and pace of agricultural development in the tribal states of the region. On the basis of the empirical data, the author depicts a disconcerting picture of the regional inequality among the hill states in respect of agricultural development in general and production and yield of foodgrains in particular. The paper also shows an agonising feature of the huge amount of central government fund finding its way into service sector and into the pockets of people other than those for whom it is meant. Rabindra Kr. Choudhury (*Planning Strategy and Agro-Economic Policy Frames—A Study of Consistency Level with special reference to N.E. India*) makes a critical analysis of the plan strategy for agricultural development in India, which according to the author, is based on many wrong assumptions. N.C. Das (*Agricultural Marketing—Need for Development of Regulated*

Markets in N.E. Region) stresses the need for development of regulated markets in the North-East Region in order to ensure a proper and smooth disposal of the produce of farmers and also help increase production and income of the farmers. Regulated market system however, is yet to be developed properly and extensively in this region. R.K. Samanta's paper 'Socio-cultural and Psychological Constraints in Technology Transfer for Agricultural Development in North-East India' puts emphasis on technology for a real agricultural breakthrough and its transfer to the ultimate users. The paper also deals with the various constraints or barriers hindering this much needed technology transfer in the case of north-east India. The author suggests various measures for successful transfer of agricultural technology. H.N. Kakoty (Barriers of Communication of Improved Technology) emphasises the paramount role of communication of improved technology in agricultural development. But in India there is a considerable gap between the total available technological knowledge at the research stations and the technological knowledge possessed by an average Indian farmer. Kakoty mentions the various important factors which influence the communication effectiveness and suggests measures for behavioural change of communication personnel. 'Constraints on Agriculture—An Inter-State Study' jointly written by A.K. Neog and G. Bordoloi throws light on the regional imbalance in agricultural production and productivity in India and the basic reasons behind it. The paper puts emphasis on the removal of various technology constraints in order to realise the highest potentiality so that the production possibility frontier of agricultural sector can have an outward shift in the backward regions of the country.

The next thirteen papers deal with the theme of agricultural development in its diverse aspects relating to Assam, the leading state of the north-eastern region. In the paper entitled 'Constraints of Agricultural Development in N.E. India with special reference to Assam', A.K. Bora discusses threadbare the basic obstacles in the development of agriculture in Assam and suggests suitable measures for achieving an agricultural break-through in the state. Ashwini Kr. Borah (Constraints of Agricultural Development of Assam) makes a realistic study of the impediments to agricultural development in Assam from the sociological point of view. The author bases his analysis of the proposition of sub-cultures put forward by E.M. Rogers which act as constraints of modernisation process in agriculture. T.N. Saikia (Problems and Prospects of Oilseeds and Pulses Production

in Assam) studies the present position of oilseeds and pulses production in the state, the impact of oilseeds and pulses development programmes already implemented and also the constraints and possibilities for the production of these essential crops in Assam. The author also gives valuable suggestions to attain the desired level of production of these essential crops in order to reduce the gap between demand and supply of edible oils and pulses in the state. Bharati Gogoi (Irrigation and Agricultural Development in Assam) analyses the evaluation study conducted by her in the district of Kamrup about the impact of irrigation on agricultural development in Assam. She also makes a comparative study between the farmers benefitted by irrigation schemes and those deprived from these facilities. Abani K. Bhagbati and M.M. Das (Structural Constraints of Agricultural Development in Assam: A Case Study of Nalbari District) make an attempt at studying the pattern of farm size and the scattering of agricultural plots and their significance as limiting factors in the development of agriculture in Assam with special reference to the district of Nalbari. The small-sized landholdings fragmented into several scattered plots create a situation detrimental to the adoption of modern agricultural practice leading to low level agricultural development. The authors recommend consolidation of scattered plots at the first stage and the holdings at a later stage and also the adoption of co-operative type of farming among the small peasants for joint cultivation. B.C. Barah (Economics of Flood Eco-System in Assam) touches upon one of the most baffling problems of Assam's economy, that is, incidence of heavy floods. The paper examines with the help of official data the relationship between ecological degradation and flood occurrence, other causes of floods, its impact on the economy and the system of financing floods as well as measures of flood disaster management. S.K. Dutta (Impediments of Institutional Finance to Agricultural Development in Assam) outlines the various institutional financing agencies for agricultural development and also examines the various constraints found in the institutional finance. M.P. Bezbaruah (Farm Level Constraints of Effective Utilisation of New Rice Technology—Some findings of Field Study in Assam) identifies factors which are hindering farmers in Assam from utilising effectively the productive potentials of high yielding rice varieties. Kailash Sarma (Supply of Labour to Agriculture in Assam—An Analytical Approach) makes an indepth analysis how human, natural and economic resources are inter-related to one another through the window of labour supply to agriculture—both owner-

cultivator, tenant-cultivator and wage earners. Haren Kr. Hazarika (Role of Mass-Media in Removing the Constraints of Agricultural Development in Assam) touches upon the most important communication link in the agricultural development. He discusses the tremendous importance of the role of mass-media like T.V., Radio, Newspapers etc. in a country like India characterised by ignorance and illiteracy and proper knowledge of our farm population in disseminating information regarding modern farm technology, weather conditions, need for environmental protection etc. The paper 'Human Labour Utilisation and Cropping Pattern in Bongaigaon District of Assam—A Case Study in Srijangram Block' written jointly by A.K. Das and D.R. Kalita examines the availability and utilisation of human labour along with the surplus labour force attached to agriculture in an interior block of the district of Bongaigaon. It also investigates the per capita income of labour and the cropping pattern for the different sizes of farms in the area under study. Dipsikha Paul Choudhury (Agricultural Practice of Zemis of Borohalong) gives a vivid account of the various constraints under which the Zemi Nagas of North Cachar hills of Assam carry on their cultivation. Samir Kr. Das (Agrarian Question and the Assamese Community—Towards a Political Framework) tries to give answer to the two sets of queries—why the force of capitalist rationality cannot assert itself in Assam's agriculture and why the other of capitalist rationality proves stronger than capitalist rationality in Assam. Biman Kar (Political Constraints of the Agricultural Development of North-East) analyses the retarded agricultural development in the North-Eastern region from the political angle. He explains the predominant role of Government and intellectuals in economic development in general as an important agent of decision-making and implementation.

There are only two papers on Arunachal Pradesh. In the paper entitled 'Agricultural Development in Arunachal Pradesh' A.K. Agarwal discusses threadbare the structure, level and growth of agricultural sector in Arunachal Pradesh. The study of the agricultural growth is based on the analysis of the trend in area, production, and productivity of the major crops and also the supply and use of essential agricultural inputs like irrigation, fertiliser etc. Gurudas Das (The Pace of Development and Emerging Structural Constraints of the Agrarian Economy of Arunachal Pradesh) analyses the cumulative effect of the various post-independence measures of agricultural development in Arunachal Pradesh on the various components of the agrarian structure

like the pattern of landownership, land-use and landholding and also agricultural practises as well as agrarian relations.

In the lone paper on Meghalaya entitled 'Constraints to Growth of Hill Agriculture in Meghalaya' N. Venkata Rao analyses the present trend of various crops in the State of Meghalaya. He also examines the contribution of various components to change in production of crops, the role of cropping pattern changes and its contribution to the growth of value of output in agriculture and the various constraints to agricultural development in Meghalaya.

The next three papers deal with the agricultural situation in Tripura. The paper 'Self-sufficiency in Foodgrains vs. Optimal Resource-use: An Exercise in Choice of Agricultural Strategy in Tripura' authored by P.R. Bhattacharjee contends that because of the geo-physical limitations, the attainment of self-sufficiency is not the proper goal in Tripura's economy, rather the state should pursue a broader and more rational strategy of optimal resource-use by putting higher emphasis on horticultural and plantation crops like oilseeds, sugarcane, cotton and mesta, animal husbandry, poultry, duckery and pisciculture etc. S.N. Chatterjee ('Shifting Cultivation in Tripura—Some Strategies for Development') gives a vivid picture of the shifting cultivation as in practice in Tripura dealing particularly with its types, specialities, crops grown, its negative impact on the economy, government schemes and programmes so far undertaken to discourage its practice and the results so far achieved. Pratapaditya Datta (Agricultural Indebtedness and Sources of Finance) attempts to find out the nature and extent of the indebtedness of the farmers in a selected village in the West Tripura District of Tripura through a sample survey.

There is only one paper on Mizoram contributed by V.S. Mahajan (Constraints in Agricultural Development in North-East with Special Reference to Mizoram Experience). Mahajan discusses the major constraints in agricultural development in Mizoram dealing particularly geographical, customary, marketing aspects of the constraints. In the last article Jogamaya Saika focusses on the 'Constraints on Agricultural Development in Nagaland.'

The editor likes to express his gratefulness and thanks to the Governing Body of the North-East India Council for Social Science Research (Shillong) for giving me the opportunity to edit the present volume. Dr. B. Datta Ray, the Secretary of the Council was the guiding spirit behind the publication of this book. It is mainly because of his initiative and sustained interest that the publication has been made

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My colleagues Dr. R.K. Choudhury, Reader in Economics and Dr. (Mrs.) Sakiya Khan, Lecturer in Economics, Gauhati University offered me valuable help in the editing work. I am thankful to them.

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1

AGRICULTURAL DEVELOPMENT IN NORTH-EAST INDIA: WITH SPECIAL REFERENCE TO SETTLED AGRICULTURE

PRANAY JYOTI GOSWAMI

The agricultural sector occupies the most prominent place in the economy of the North-Eastern Region of India comprising of Seven-Sister-States, viz. Assam, Meghalaya, Manipur, Nagaland, Tripura, Mizoram and Arunachal Pradesh. The region covers a total geographical area of 2.5 Lakh Sq.Kms. having a population of 26578.00 (according to 1981 census).

Bulk of the population in this region is rural in character ranging between 85.1 per cent in Meghalaya to 95 per cent in Arunachal Pradesh. Work participation rate in the region is 49.19. About 75 per cent of the total working population is engaged in agricultural sector. In spite of this, the region is agriculturally very backward. Rice is the major crop in this region. The other important crops are wheat, pulses, potatoes, millets, sugarcane, etc. But the yield rates of these crops are lower than that of India as a whole. It is shown in Table 1.1 that yield rates of some major crops, e.g. rice, wheat, oil seeds in North-Eastern India is much lower than India as a whole.

This gap increases if we compare the region with the agriculturally developed regions like the Punjab and Haryana. For example, the yield rate of rice, wheat and sugarcane in Haryana was 2447, 2592 and 41854 kg. respectively in 1984-85.¹ The compound growth rate of agricultural production is also very low in the region. For example, this rate was 2.4 per cent during the period 1967-68 to 1985-86 in Assam against the national rate 2.7 per cent.²

TABLE 1.1

Yield Rates of Rice, Wheat, Oil Seeds in North-East India and India as a whole in 1984-85 (Kg./Hectare)

<i>Crop</i>	<i>North-East</i>	<i>India as a whole</i>
Rice	1122	1417
Wheat	1067	1870
Sugarcane	47811	57673

Source: Basic Statistics of North-Eastern Region, 1987, Shillong, pp. 32-47.

Let us now analyse the reasons of this poor agricultural performance in the region. In doing so, we must consider the geographical situation of the region. Unlike Punjab and Haryana, the land of North-East India can broadly be divided into two divisions: (i) Plains, and (ii) Hills. About 70 per cent of the land area is hilly and the rest 30 per cent comprising all districts of Assam except Karbi-Anglong and N.C. Hills, and a part of Tripura and Manipur is in the plains. The technique of agriculture in these two areas also differ. In the Hills, the people generally do shifting cultivation (Jhumming) which has a negative impact on the hill economy and ecology. This system is responsible for soil-erosion, floods, climatic changes and destruction of many rare species of flora and fauna. Terracing, an alternative to Jhumming, is only popularised among the tribals of Arunachal Pradesh and Angamis. But it fails to attract even 1 per cent of the total tribal population.³ On the other hand, in plain area a majority of the people maintain their livelihood chiefly from settled agriculture or plains agriculture. The technique and problem of plains agriculture is almost alike in the region as a whole and that is why the present paper seeks to find out constraints of agriculture with special emphasis on settled agriculture.

There are many constraints of agricultural development in North-Eastern region. One of the major constraints is the low level of irrigation facilities. About five-sixth of the net cropped area is still cultivated under uncertain monsoon condition. 22 per cent of the total arable area in the region was irrigated in 1986 ranging from 10.4 per cent in Mizoram to 46.4 per cent in Manipur.⁴ But the irrigation facilities utilised in the region is less than irrigation potential created

because of defective irrigation management. In many cases irrigation is not assured.

Flood and drainage problems are quite serious in the region. "During the four monsoon months a vast portion of the areas of the Barahmaputra and Barak Valley are subjected to the fury of floods which take a heavy toll in life and property besides causing extensive damages to standing crops".⁵ Since the inception of Brahmaputra Flood Control Commission (BFCC) in 1970, crores of rupees are being spent for flood control, but the fury of flood is increasing day by day. For example, in Assam flood which use to affect about 4 Lakh hectares in the yester-years has increased its devastations to around 9 Lakh hectares in recent years and some areas which were considered flood-free have now been rendered flood prone.⁶ This is perhaps because, as a result of silt deposit, the rivers are losing their depths but the BFCC has given much emphasis on construction of embankment and dams rather than drainage of the rivers. The other parts of the region especially Manipur and Arunachal Pradesh are also not free from the havoc of flood. Thus flood or drought may occur owing to uneven distribution of rain overcast sky during the period of Monsoon and low temperature during winter limits productivity through reduced photosynthesis. Warm humid climate with overcast sky forms a congenial environment for growth of insects and weeds.

As there is lack of proper irrigation facilities and flood control measures most of the areas of the region are single cropped. For instance, in North-East India only 1041000 hectares out of 4646000 hectares of cropped area are in the arena of multiple cropping.⁷

Thus, by proper irrigation facilities and flood control measures, even at the existing level of technology, there is a scope of three-fold increase in agricultural production in the region because a large part of the single cropped areas can be brought under the system of multiple cropping.

There are many technological constraints in the region. Use of fertiliser is still at a low ebb. For instance, during 1983-84 while consumption of fertilisers per hectare of cropped area was 162 kg. in Punjab, 73 kg. in Tamilnadu, 69 kg. each in Andhra Pradesh and Uttar Pradesh, 58 kg. in Haryana and about 45 kg. in the country as a whole, whereas in Assam it was found to be only 5 kg. during the same year.⁸ In 1988-89, it is 7.5 kg. per hectare. In 1980-81, consumption of plant nutrients per hectare in North-East ranges from .4 kg. in Nagaland to 13.7 kg. in Manipur whereas for India as a whole this rate was 32.3 kg.

per hectare.⁹ One of the reasons of this low rate of fertiliser consumption is that the use of fertiliser under flood prone or drought prone condition is found to be unprofitable. The use of H.Y.V. seeds is also limited. About 30 per cent of the net sown area under modern varieties. Sometimes, our cultivators do not get H.Y.V. seeds timely. North-Eastern Region has to depend on outside sources for quality seed to a great extent. The distribution of various kinds of pesticides at village level are most unsatisfactory. Though the pests attack in the North-Eastern region is high, yet consumption of pesticides is very low. In Assam, only 9.18 per cent farmers use pesticides.¹⁰ About 99.5 per cent of the cultivators use cattle for ploughing which are of local breed. These poor cattle has no capacity to cultivate the land twice or more. There are also problem of grazing land in most of the villages especially during the Khariff season. The use of modern instruments is also limited because of high cost. For example, there were 289 tractors, 451 power tillers and 1374 seed drillers in Assam in 1982.¹¹ The performance of institutional sources of credit is far from satisfactory. A survey conducted by the author in the plains tribal villages of Barak Valley in 1984 reveals that institutional sources provides only 13 per cent of the total credit requirement of the farmers. The average annual rate of interest on the money lent by village money-lenders is 250 per cent till now. Agricultural prices do not cover costs of production because of low productivity and high cost of credit. That is why most of the marginal and small farmers want to dispose of their land to a comparatively big land-owners.

Another factor deserves special attention. There is a high degree of correlation between road development and agricultural growth rate. In agriculturally developed states like the Punjab and Haryana, all the villages are approachable through the black-topped road. Not only that, villages have circular roads around, making the black-topped road accessible to every village household. But the fact that, in the North-Eastern region, there are many isolated villages where roads have not yet been constructed, also stands as a bar on the way of agricultural development.

So, stress must be given on the multipurpose co-operative system for timely supply of improved seeds, fertilisers, pesticides, for procurement of paddy and providing credit money in each pargona or circle. Agricultural pricing policy should be evaluated and special attention should be laid on improvement of marketing system and infrastructural development especially the building and improvement

of roads and power supply systems.

Annual rainfall rate in the North-Eastern region is very high. Mousimram of Meghalaya is noted for highest amount of rainfall in the world. In spite of this, we are facing water and power crisis in some months of the year. If the rain water is managed properly, our region will rank first among the states of India in terms of food production, irrigation and power consumption. If the Chinese can control "Huwang-Ho" for the development of China, why can we not control and utilise the current and water resources of the mighty river Brahmaputra and the Barak for the development of our region?

Coming to the land, there are two types of constraints (i) Natural, and (ii) Socio-economic. First, 90 per cent of the land of North-East India is acidic and that is why cropping pattern in the region is mostly characterised by mono-cropping with rice. Agricultural scientists are doing research work for diversification of cropping pattern in the region and in near future with the blessings of science, diversification of cropping pattern even in the acidic soil will be feasible. Secondly, owing to the implementation of land ceiling and law of heredity, the number of small and uneconomic farm unit is increasing. Average size of holding in the region ranges from 5 to 2.00 hectare with more than 50 per cent holding having the size of less than 1 hectare. More than 70 per cent of the farmers belong to the small and marginal category¹² who fail to maintain even their subsistence level of living. Again, land records in many cases are not up-to-date which sometimes stand in the way of creditworthiness of the farmers. So, fragmentation of land-holding can be solved to a great extent by consolidation of holding and by popularising the principle of co-operation among the farmers. Village panchayats can be engaged in the work of preparation of up-to-date land records.

Last but not the least, there is also constraints on the way of transfer of technology. Education of the farmers, devotion and sincerity of the agents who are engaged in this work and the co-ordination among the different governments and voluntary agencies are the prerequisites of the success of transfer of technology. Unfortunately, these factors to a great extent, are not favourable in the region. Educational development and opening of more research stations in different districts can go a long way for the development of agriculture in the region.

In fine, we can say that there is a considerable scope of expansion of the cultivated area in the region. It must be noted that in North-

Eastern region 785,000 hectares of land termed as cultivable waste land.¹³ About twenty per cent of the cropped area remains uncultivated in almost all the year. In 1981-82, 14,30,000 hectares of land remained fallow in North-East region.¹⁴ If social investment with regard to the provision of water and development infrastructures are made in a rationally phased manner, there is no reason why a major part of the soil cannot be brought under cultivation within one decade.

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CONSTRAINTS OF AGRICULTURAL DEVELOPMENT IN THE HILLY REGIONS OF NORTH-EAST INDIA

DURGESWAR BORAH

The North-East India comprising seven states, viz., Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram and Tripura covers 8.00 per cent (25.505 thousand hectares) of the total geographical area of the country with 3.38 per cent of the total population. More than 86 per cent population of this region lives in rural areas (1981) and majority of them are dependent on agriculture for their livelihood. The percentage of net cultivated area to total reporting area for the region is only 16 as against about 47 per cent for the country as a whole. Although more than 65 per cent of the total workers are engaged in agriculture (1981), the region is lagging far behind other areas of the country in production, yield, etc. of agricultural commodities. So, the area has to depend on other parts of the country particularly for its deficit foodgrain requirements.

The situation in the hilly areas of the region is worse than that in the plain areas. More than 70 per cent of total geographical area of this region is covered by hills. Except the tiny river valleys between the ridges, shifting cultivation is the common practice of agricultural production in these hills. Shifting cultivation is an age-old crude method of crop production in the hilly areas throughout the globe to which North-East India is not an exception. Of late, terrace cultivation has been encouraged by the State government though it is not new to some of the tribes like the Angamis and the Chakechangs of Nagaland who devised this system of crop production in their respective areas

years back at their own initiative. Similarly, the Apatanis of Arunachal Pradesh also constructed their terrace land at their own. These tribes are still continuing their terrace cultivation.

Notwithstanding this, majority of the hill tribes of the region are even now shifting cultivators. If factors like physiological conditions of the hills, climate, poor communicational infrastructure, etc. are taken into consideration one may be convinced that shifting cultivation has some plus points for those who have been practising it. But at the same time, every body agrees that shifting cultivation is not only unprofitable for the practising families; but also it leads to ecological imbalance, soil erosion and soil degradation, loss of valuable forest products and flooding in the river valleys down below. It is desirable that 60 per cent of the land surface in the hills be covered with forest and vegetation. But the continued deforestation for shifting cultivation and felling of trees for fuel and timbers have caused heavy erosion of the top soils of the hilly areas. Again, ever increasing population pressure even in the hilly areas of North-East India leads to shortening of *Jhum* cycle to even 2-3 years in some of the hills (Table 2.1). As a result, the soils fail to recuperate fertility thereby lowering the yield rate of crops under shifting cultivation. Because of these, agricultural production in the hilly regions suffers causing adverse effect on the economic life of the people concerned.

The government of the various states of North-East India are very much aware of the menace of shifting cultivation and they have taken various schemes for the control of shifting cultivation. Some of such schemes are implemented by the State Government while some others are executed under the guidance of the Central Government. The Primary aim of these *Jhum* Control Schemes was to reclaim land, reduce soil erosion and reforest the demanded areas. In addition to soil conservation measures some states are attempting alternative programmes for controlling the practice of shifting cultivation.

The Government of Assam proposed to resettle about 11,600 shifting cultivator families in Karbi-Anglong and North Cachar Hills district and employ them on wages in rubber and coffee plantations under the scheme "The permanent settlement of *jhumia* cultivators through development of plantation crops."

The Government of Meghalaya proposes to wean away the *jhumias* by settling them in various parts of the State by providing 2.00 hectares of terraced land to each family for permanent cultivation under the *Jhum* Control Scheme. Inputs like seeds, fertilisers, manures, etc.

were supplied free of cost besides ploughing the field in the initial year. Over and above these, each family was given Rs. 2000.00 for construction of dwelling house in the new site. This scheme was implemented in those areas where hill slopes were brought under terrace.

TABLE 2.1

Shifting Cultivation in North-East India

<i>States</i>	<i>Annual area under shifting cultivation (sq. km.)</i>	<i>Fallow period (in yrs.)</i>	<i>Minimum area under shifting cultivation one time or other (sq. km.)</i>	<i>No. of families practising shifting cultivation</i>
Arunachal Pradesh	700 (1.30)	3-10	2,100 (3.89)	54,000
Assam	996 (1.20)	2-10	1,392 (2.4)	58,000
Manipur	900 (1.29)	4-7	3,600 (5.14)	70,000
Meghalaya	530 (1.01)	5-7	2,650 (5.07)	52,290
Mizoram	630 (1.26)	3-4	1,890 (3.18)	50,000
Nagaland	190 (0.16)	5-8	1,913 (1.65)	1,16,046
Tripura	223 (0.52)	5-9	1,115 (2.59)	43,000
Total	3,869 (0.87)		14,660 (3.31)	4,43,336

Note: Figures in the parenthesis indicate area available per family.

Source: Basic Statistics, NEC, 1987; NEC Compiled from Task Force Report on Shifting Cultivation, Ministry of Agriculture, (1983).

The Mizoram Government proposes to launch two schemes under *Jhum* Control measure. The first is: (a) Pilot Project in four selected villages; and the second (b) eight grouping centres. Both the schemes include land reclamation, minor irrigation, post-reclamation, land improvement, provision of machinery, seeds, fertilisers, etc. and development of horticulture and cash crops.

The Nagaland Government started demonstration pilot projects to induce the farmers to give up *jhum* cultivation and take up permanent terrace cultivation of rice. In order to accelerate the acceptance, the Government engaged Angami and Chakesang cultivators, who has skilful expertise in their indigenous method of terrace cultivation, to train up other Naga tribes in terrace cultivation.

The task of implementing the *Jhum* Control Scheme has been entrusted to the concerned departments by the States. Of these the department of Soil Conservation and the Department of Agriculture are given the major responsibilities. In Tripura the department of Tribal Welfare and the Forest department are tagged with Agriculture Department for implementation of the *Jhum* Control Schemes in the State. While in Assam the Soil Conservation Department and the Agriculture Department are sharing the task.

The estimated tribal population dependent on *jhuming* in the coming decades as calculated by the North-Eastern Council, Shillong at an average rate of 24 to 30 per cent for different constituent units from the base year figure of 1974 is expected to be about 7.66 lakh families by 2000 A.D. So it is already late to control the situation by providing the *jhumias* with alternative and remunerative means of livelihood.

DENSITY AND PER CAPITA NET AREA SOWN

Table 2.2 shows that density of population in the states of North-East India except Assam is much lower than that for India as a whole. It is as low as 8 persons per sq. km. in Arunachal Pradesh. But 3.88 per cent of total population of India living in this region has to be satisfied with 2.54 per cent of net area sown for the entire country. This is because of coverage of a large portion of the region with hills and mountains. The per capita net area sown in the states of North-East India except Nagaland is much lower than that for India as a whole. This indicates a major problem of the cultivators of the region.

Though density of population in the hills is thin, per capita availability of land suitable for agricultural purposes is very low because of the nature of slope, elevation and other topographical factors. The supply of land is limited in another sense. Shifting cultivation involves extensive use of land. The position of operational holdings by farm size and occupational classes in six hill villages studied by the Agro-Economic Research Centre for North-East India, Jorhat at different times is shown in Table 2.3. It is seen that only 10.8

TABLE 2.2

Density and Per Capita Net Area Sown in the State of North-East India, 1981-82

(Area in '000 hectares)

States	Geographical Area	Reporting area for land utilization	Population (1981)	Density (per sq. km)	Net Area sown	Per capita net area sown (in hectare)	Area sown more than once
Assam	7,852	7,852	19,896,843 (Projected)	254	2,696 (34.34)	0.14	743 (9.46)
Arunachal Pradesh	6,358	5,550	631,839	8	112 (2.02)	0.17	40 (0.72)
Manipur	2,236	2,211	1,420,953	64	140 (0.63)	0.10	100 (0.45)
Meghalaya	2,249	2,249	1,335,819	60	193 (0.86)	0.14	10 (0.04)
Mizoram	2,109	2,102	493,757	23	65 (0.31)	0.13	3 (0.01)
Nagaland	1,653	1,099	774,930	47	153 (1.39)	0.20	11 (0.10)
Tripura	1,048	1,048	2,053,058	196	246 (2.35)	0.12	134 (1.28)
Total	25,505	22,111	26,607,199	104	3,605 (16.30)	0.14	1041 (4.70)
All India	3,28,726	3,04,280	685,184,692	216	1,42,002 (46.67)	0.21	35,039 (11.52)

Note: Figures in parentheses indicate percentages to the total reporting areas.

Source: Basic Statistics of North-East Region, NEC, Shillong, 1985.

per cent of the farmers do not practise shifting cultivation. On the other hand, the average size of farms in the hill villages is only 1.20 hectares. It is observed that the available land suitable for settled cultivation in the hill villages has already been developed by the local people in their own way and put to settled cultivation.

TABLE 2.3

**Distribution of Operational Holdings by Occupational Classes
(in Six Hills Villages)***

<i>Occupations</i>	<i>Percentage of H.H</i>	<i>Operational Holdings</i>		<i>Average Farm Size</i>
		<i>Jhuming</i>	<i>Settled farming</i>	
Solely Jhuming	58.69	125.56	--	1.00
Mainly Jhuming	19.72	45.19	14.25	1.42
Solely Settled	9.39	--	39.52	1.98
Farming				
Mainly Settled	1.41	3.18	3.48	2.22
Farming				
Misc. Agril.	1.41	--	2.13	0.71
Services				
Salaried Job	4.69	4.86	1.95	0.68
Profession and	2.34	0.81	2.22	0.61
Services				
Production other than Agril.	0.47	--	0.10	0.10
Agril. Rent Receiver	1.88	--	12.60	3.15
Total	100.00	179.60	76.25	1.20

* The Six Villages are: (1) Kanther Terang (Assam), 1966, (2) Mawtnum (Meghalaya), 1964, (3) Bansidua (Meghalaya), 1964, (4) Pakam (Arunachal Pradesh), 1970, (5) Khonsa (Arunachal Pradesh), 1965 and (6) Hmunpui (Mizoram), 1965.

Since usually land in communally owned among the hill tribes, every household should possess a farm. But in the surveyed villages six households were found without any farm land. This is considered an exception as some diversification from traditional occupation has taken place. Facilities available for occupation diversification from the

growing nearby townships to six of the household mentioned above might be the main cause of non-use of *Jhum* land. It is observed from Table 2.4 that 82.57 per cent of these households are small farmers operating land between 0.40 to 2.03 hectares. Large farmers were found in Mawtnum village (Meghalaya) where settled cultivation predominates. Under shifting cultivation farm size is dependent on working hands in a family as hired labour for *Jhum* cultivation is usually not found. Small farms are usually considered as uneconomic holdings. So, agricultural development suffers in the region.

TABLE 2.4

**Distribution of Operational Holdings by Farm Size
(Six Hills Villages)**

Farm Size (in hectare)	No. of HH	P.C. of HH.	(Area in a hectares)		
			Operational Holdings		
			<i>Jhumming</i>	Settled Farming	Total Opera- tional Holding
Without any Farm	6	2.75	—	—	—
Below 0.405	14	6.42	1.92	1.33	4.24
0.405—1.01	96	44.04	56.16	7.30	63.46
1.01—2.03	70	32.11	73.57	23.68	97.25
2.03—3.04	24	11.01	33.60	19.67	53.27
3.04—4.05	5	2.29	13.36	6.08	19.14
4.05—6.08	2	0.92	-	10.26	10.26
6.08—9.10	1	0.46	-	7.93	7.93
Total	218	100.00	179.60	76.25	255.85

Use of soil nutrients is another important factor of agricultural development. But the consumption of plant nutrients in the states of North-East India (as shown in Table 2.5), even in the states having large plain areas, is far from satisfactory. Use of plant nutrients in Arunachal Pradesh and Mizoram is negligible. No plant nutrient, chemical fertilizers or organic manure, is used in shifting cultivation. Though Meghalaya registered a use of 16.20 kg. of chemical fertilizer per hectare in 1986-87, the bulk is used in potato and other vegetables

TABLE 2.5

Consumption of Plant Nutrients per Unit of Grossed Cropped Area, 1984-85 to 1986-87

(kg/hectare)

States	1984-85				1985-86				1986-87			
	N	P ₂ O ₅	K ₂ O	Total	N	P ₂ O ₅	K ₂ O	Total	N	P ₂ O ₅	K ₂ O	Total
Assam	2.10	0.80	1.00	3.90	2.60	1.00	1.10	4.70	2.40	0.90	1.00	4.70
Manipur	17.40	2.90	0.30	20.60	21.20	4.30	0.30	26.30	23.50	6.20	1.00	30.70
Meghalaya	7.90	5.50	0.70	13.60	7.50	6.10	0.80	14.40	8.70	6.50	1.00	16.20
Nagaland	0.90	0.60	-	1.50	0.90	0.30	0.05	1.25	0.90	0.80	0.10	1.80
Tripura	5.50	1.50	1.30	8.30	9.30	2.70	1.90	13.90	12.10	3.50	2.60	18.20
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	-	-	-
Mizoram	-	-	-	-	-	-	-	-	-	-	-	-
All India	30.40	10.50	4.60	45.50	32.20	11.50	4.70	48.40	32.10	11.70	4.90	84.70

Source: Fertilizer Association of India compiled by NEC, Shillong.

cultivation. Without the use of chemical fertilizers and organic manure one cannot expect to raise the yield rate of crops.

Besides poor economic resources as mentioned above the following constraints of agricultural development are identified in the hilly regions of North-East India:

(1) The officers of various implementing agencies of developmental plans in the hilly areas blamed the farmers for their alleged laziness or apathetic attitude while the farmers complain that there is lack of sincerity on the part of the officers in disseminating knowledge of technology and seeds, fertilizers (for settled cultivation) etc. are not supplied in proper time. On the whole, the main complain of the farmers is that the extension services of the implementing agencies need complete reorientation.

(2) There is lack of co-ordination among the agencies which are directly involved in the implementation of the Jhum Control Schemes and other allied agencies. These agencies should come forward with technical knowledge and other helps. The Soil Conservation Department is implementing the Jhum Control Scheme in Meghalaya; but it was alleged that the Agriculture Department is not co-operating with the Soil Conservation Department with its available resources. Similarly, the departments of Fishery, Veterinary, Co-operation, etc. should come forward to help the farmers. The Banks may play a vital part by offering credit to the needy farmers on easy terms. But it is observed that co-ordination among the departments is badly lacking. As a result even an enthusiast farmer finds him at a loss as to what to do at certain stage. Finally, he has to give up the idea of going with the Jhum Control Scheme and he retreats to his *jhum* land.

(3) It is learnt that the soil of an area where various measures of Jhum Control Scheme are introduced are not scientifically analysed as to its suitability for the crops to be introduced there. The result is obvious failure in many cases. This has totally discouraged the *jhumias*. In spite of the evil effects of shifting cultivation there is a surity of crop for the farmer in the method. Because as mixed cropping is the general pattern of shifting cultivation, the farmer gets the production of certain crops even if some other crops in his farm are damaged.

(4) The alternative measures of crop production to traditional shifting cultivation is no-doubt welcome. It is learnt that the economic feasibility of certain alternative means of livelihood, i.e., bee-keeping, poultry farming, cattle farming, horticulture, etc. were not properly

examined before their introduction among the shifting cultivators. Bee-keeping for many households in a village may not be feasible. Poultry farming, cattle farming, etc. need constant guidance and assistance from the Veterinary Department and for horticulture besides proper soil analysis and other guidance, etc., a ready market is required.

(5) Infra-Structural facilities such as communication, irrigation and easy marketing facilities are of utmost necessity. Transport of perishable surplus agricultural products must be immediately made to marketing Centres for the benefit of the farmers. For want of it, it so happens that, the entrepreneuring farmers abandoned cultivation of such crops even with good harvest after the initial year. Pineapple produced in large numbers in a particular district in Arunachal Pradesh could not be sold for want of market and transportation facilities and in the subsequent year the farmers left the gardens for stray cattle. Similarly, banana produced in large numbers in certain pockets near Maibang in the N.C. Hills got rotten in the villages for want of market.

(6) Expansion of terraced land in the hilly areas of the region enhances the importance of irrigation facilities. To increase the farm efficiency in crop production the application of irrigation facilities for timely supply of water is a must which makes even the small holdings economically viable. But most of the terraced land constructed by the government and allotted to the *jhumias* are dry terraces. Even where irrigation is introduced, it cannot water the entire fields in time as in the case of Darengiri (Garo hills) terraced fields. For want of irrigation the farmers cannot grow paddy there which is their primary requirement. This is one of the important factors of abandoning government constructed terraced fields by the farmers. Low yield of crop in terraced field is another factor. It was found that in Darengiri yield per unit of land under terrace cultivation was lower than that under shifting cultivation. But most of the terraced land can easily be irrigated by channelizing the rain water in the hills.

Lack of assured irrigation in the settled farming areas throughout the year stands in the way of double/multiple cropping.

(7) The role of middlemen in procuring agricultural products is another problem. The middlemen exploit the farmers and the farmers do not get their due share for their produce. Throughout the hills of North-East India, this is a burning question. The monopolist traders of Shillong have been exploiting the pineapple and potato growers of Meghalaya. The cotton producers of the N.C. Hills and Karbi Anglong districts of Assam are also victims of middlemen. Being unable to

holdback the agricultural products like cotton, Sesamum, etc. for want storage of facilities, the hill farmers are compelled to dispose of their produce just after harvest at low prices and thus are exploited by the middlemen.

(8) Processing centres for certain agricultural products are badly needed in the region. Cashewnut plantation was encouraged in Garo-Hills of Meghalaya. But no cashewnut processing centre came into being in the area. So the farmers stopped taking care of the cashewnut plants. Similarly, establishment of processing unit for pineapple in the pineapple growing areas in Arunachal Pradesh or establishment of a banana processing centre at Maibang or a potato chip industry at Shillong, or an apple processing centre in Kameng district of Arunachal Pradesh where apple is produced in abundance could have ensured ready market and remunerative income to the growers. Establishment of a Milk processing unit at Maibang would have encouraged a large number of Dimasa buffalo rearers to take care of their buffaloes for milking purposes. The Dimasas hitherto use the buffaloes only as draught animal and let them loose most of the time in a "Semi-Wild" condition.

(9) In some cases land allotted to the farmers is not sufficient to subsist for the whole year. Sometimes terraced land actually suitable for horticultural crops are allotted to raise paddy. This has happened because no soil survey was done before allotment.

(10) Sometimes because of poverty of the farmer he cannot develop the allotted land for settled cultivation. On the other hand, the farmer cannot devote his entire time for land development as he has to work elsewhere to earn bread for his family. Under such circumstances either he has to borrow money which he cannot refund or to sell his allotted land to *Mahajans* or big land owners. In Tripura big land owners and *Sardars* (Village Chief) have claimed the developed land allotted to the poor settlers and sometimes forcibly occupied such land and thus deprive the actual beneficiaries. This shows that poverty and indebtedness has led to land alienation in Tripura.

CONCLUSION

The notion that tribal people are generally averse to any change in the mode of crop production is no longer tenable. The planners, administrators and the implementing agencies must be very careful before introducing any new programme of development in a particular

area for a particular group of people. They must be sure that the alternatives to shifting cultivation or for that matter any other form of crop production are remunerative and suitable for the people. It has been observed that the alternatives to shifting cultivation evolved by the hill people themselves have been found to be successful. As these alternatives are evolved by themselves because of situational demand and the necessary devices for such cultivation are their own, the question of compulsion does not arise. The people work there with utmost sincerity. The adoption of new method becomes spontaneous due mainly to the endogenous urge of the people. In such a situation whatever change in socio-cultural life have occurred are not abrupt and disruptive. Adjustment of the people in the changing situation are found to be smooth and steady. In the case of economic life also adjustment is found to be spontaneous and regular. The Dimasas, a hill tribe of the N.C. Hills adopted plough cultivation in the narrow river valleys in N.C. Hills District and in the plains of Karbi Anglong District, the Garos adopted plough cultivation in the foot hills and the plains, the Angamis and the Chakechangs of Nagaland, the Apatanis and the Monpas of Arunachal Pradesh evolved terrace cultivation and adopted it long back. But nowhere in these cases any disruption in their socio-cultural life has been reported. The change over is found to be smooth and spontaneous.

From the above instances it can be said that the hill tribals are eager to adopt new method of crop production, whatever it may be, provided they found that it is remunerative and suitable to the local soil. But when there is an imposition from above in the name of development without convincing them of the utility of such programme, the tribal people may react adversely. On the other hand, the *jhumias* alone cannot be blamed for ecological imbalance supposed to be caused by the practice of shifting cultivation. The unscrupulous traders who cut down valuable forest trees at the connivance of certain greedy politicians, administrators, forest officials, etc. are also equally responsible for the hazards of ecological imbalance. From our field experience, the following points may be put forwarded as concluding remarks.

(1) The implementing agencies of various plans for agricultural development in the hilly areas must be sure of success of such plans in a particular area before they introduce it. For this purpose the plans should be area specific instead of being common for all over the hills.

(2) Before introducing a new programme the local farmers should

be consulted and only after convincing them (through demonstration or otherwise) such programmes be introduced.

(3) Arrangement for sufficient extension services must be made well-a-head of time. Extension personals who are not committed to the cause of the farmers should be replaced by actually committed ones, and for this, if necessary, some incentive to such officers may be introduced.

(4) Intra-structural facilities, i.e., assured irrigation, roads, markets must come into being.

(5) Processing Centres (for rubber, coffee, etc.) as well as marketing centres be made available in the vicinity of producing centres.

(6) For the control of the exploitation of the middlemen, the government may fix support price for various crops.

(7) The *Khondua (Paikan)* system that prevails in Karbi-Anglong District of Assam or elsewhere must be abolished and the local people be persuaded to cultivate their own land.

(8) When the shifting cultivators come forward to start with plantation of coffee, rubber, horticulture gardening, etc. remunerative alternative means of income be given for the intervening period, i.e., upto the time of getting return from his plantation.

(9) The task of evolving new variety of crops suitable for high altitude (for the Hills) should be entrusted to agricultural scientists. Usually the traditional varieties of crops grown in the hills are giving low yield.

(10) Cadastral survey of the entire hilly areas of the region must be made without delay for efficient land use planning.

(11) Steps for chemical testing of the soils of various parts is urgently required to introduce new variety to crops to get better yield.

(12) The use of improved tools and implements for quick operation signifies modern transformation in agricultural technology. Importance of such tools and implements increases in the hilly areas with the expansion of terraced land. So, technocrats, particularly agricultural engineers be induced to develop such efficient implements suitable to use in the hilly areas.

(13) The motivational task towards scientific cultivation be entrusted to local youths who are committed to local development and who are having social position in the village or community. It is much easier through a leader from amongst the farmers to convince them to adopt any innovation in crop production.

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3

AGRICULTURAL PRODUCTION CONSTRAINTS IN NORTH-EAST INDIA

S.K. AGNIHOTRI

In spite of high priority given to agricultural production in successive plans of various States in the North-East India, the progress in this sector has been inadequate. Agriculture in the North-East has generally not benefited from modern technology and has not registered any significant increase in productivity. Except for Assam which has a large plains area, most of other States are hilly. Even in Assam there is a distinct hill zone comprising of two hill districts of Karbi Anglong and North Cachar. The plains areas consist of north bank plains, Brahmaputra Valley (upper, central and lower) and Barak Valley. In the States of Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura most of the areas are hilly and alpine or tropical. Darjeeling district of West Bengal also comes in alpine category.

The *north bank plains*¹ of Assam consist of alluvial or sandy loam soils with medium to high nitrogen, medium in potassium and low in phosphorous. The annual rainfall is more than 2000 mm. The irrigated areas was 74000 ha. in 1984-85. The *upper Brahmaputra valley*² has alluvial sandy loam soil, medium in nitrogen and potassium and low in phosphorous. In this valley also, the annual rainfall is more than 2000 mm. During 1984-85, the irrigated area was 48,000 ha. Soils belong to alluvial sandy to sandy loam category in the *central Brahmaputra valley*.³ These contain medium to high nitrogen, low phosphorous and medium to low potassium. The annual rainfall is approximately 1400 mm. The total irrigated area was 67000 ha. in 1984-85. The *lower*

*Brahmaputra valley*⁴ consists of alluvial sandy to sandy loam with medium to high nitrogen content, medium phosphorous content and medium to low potassium. The annual rainfall is 1800 mm. The existing irrigated area was 1,19,000 ha. in 1984-85. In the *Barak valley*⁵ the topography is rolling undulating and soils are alluvial and red loam, clay to clay loam. Nitrogen and potassium content is medium to high, whereas potassium is medium. The annual rainfall is more than 3000 mm. During 1984-85 the irrigated area was 6000 ha. The soils in *Assam hills*⁶ are either lateritic red loam or alluvial with medium nitrogen, phosphorous and potassium content. The annual rainfall is 2800 mm. The area of irrigated land was 21000 ha. in 1984-85.

There are six agro-climatic zones in the North-Eastern hill region consisting of the States of Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim and Tripura besides Darjeeling district of West Bengal. The details of these six zones are given below:

The alpine zone consists of the States of Sikkim, Arunachal Pradesh and Darjeeling district in West Bengal. It has mostly Himalayan rocks which are mostly acidic. The annual rainfall is above 3000 mm. The *temperate sub-alpine*⁷ zone mostly consists of mountain ranges with annual rainfall of above 3000 mm. The *sub-tropical hills*⁸ consist of loamy silt which is low to medium in organic matter, and low in phosphorous. The annual rainfall is 1600 mm. Soils belong to alluvial category in *sub-tropical valley*.⁹ The annual rainfall is 1500 mm. In *mild tropical hills*¹⁰ the soils belong to loamy silt category and are low in organic matter and phosphorous. The annual rainfall is 1400 mm. *Mild tropical plains*¹¹ consist of laterite and alluvial soils with an annual rainfall of 2000 mm.

Main constraints of production in Assam and North-Eastern hill region are natural, technological and sociological. A systemic view is necessary to find out a solution. In major parts of Assam plains agricultural lands are mostly rainfed with periodic droughts between rains. Occasional floods also occur. Provision of adequate irrigation facilities through tanks, water harvesting and recycling is the most urgent need in North Bank plains and upper Brahmaputra valley. Irrigation potential already created has not been utilised to the optimal capacity either due to sociological problems or due to technical defects. In central Brahmaputra valley, suitable submergence tolerant varieties should be adopted with provision of surface drainage and adoption of paddy-cum-fish culture. Drought tolerant Ahu variety with short duration maturity could also be tried. In Barak valley use of

extra early (Aus) and food tolerant medium late and medium tall (sali) varieties may be promoted. In all the plains areas, adoption of High Yielding Varieties of crops should be encouraged. In most of the areas, there is very low nutrient consumption. Steps should be taken to promote application of adequate nitrogen, phosphorous, potassium and bio-fertilizers with proper rate, time and method of application. Timely and adequate supply of inputs particularly seeds should be organised. As most of the farmers are poor due to frequent floods and drought resulting in crop damage, crop insurance cover, credit and subsidies may be made available. Development and use of suitable varieties for late planting with aged seedlings having medium late maturity may be promoted in flood prone areas. This would also include development and growing of suitable plant types/varieties for flooded and deep water areas. Steps are required for extension support for suitable agro-techniques including demonstration and training. Adoption of cheap and efficient plant protection measures/integrated pest and disease management/use of resistant varieties should be encouraged along with development and extension of low cost technology like proper plant stand, improved variety, timely and proper method of fertilizer application.

In Barak valley land levelling and growing suitable varieties and crops for undulating topography is recommended.

Adequate soil conservation measures to contain soil erosion and encouragement of terracing/growing plantation crops is recommended on slopy lands in Assam hills. Incentives should be provided for settled cultivation along with provision of credit and subsidies. Means should be adopted for moisture conservation, water harvesting and recycling. In all the areas, development of marketing and procurement infrastructure are necessary.

In alpine regions, pasture management practices for livestock enterprises should be developed as climatic limitation restricts cultivation of crops. Natural vegetation should be managed for ecological sustainability and productivity in view of deforestation and consequent reduction in productivity of pastures.

There is excessive moisture during monsoon and moisture stress in post monsoon season in temperate sub-alpine regions. In these areas, development of temperate horticultural farming/terracing to reduce run off/erosion, and maintenance of natural vegetation on steep slopes is considered necessary. Timely control of pests and diseases in rice should be organised in view of pest and disease incidence due to high

humidity. Low phosphorous availability and iron toxicity in pockets should be neutralised following the practice of organic recycling, use of rock phosphate and liming to reclaim acid soils. To overcome the effects of shifting cultivation, settled cultivation should be promoted with organic recycling instead of slash and burn system. Production incentives/credit/subsides/inputs/training and demonstration are necessary in view of widespread poverty in tribal areas. In these areas, farmers adhere to local varieties and technology. To overcome this problem, adoption of cold tolerant high yielding short duration varieties of crops having multiple resistance and improved technology is recommended.

Settled cultivation through proper land tenure system/terracing to reduce run off losses/organic recycling is necessary to control shifting cultivation in sub-tropical hills. Plant protection measures at the appropriate time and growing of resistant varieties of rice should be organised in view of high pest and disease problems. This should be accompanied with adoption of drought tolerant, short duration and disease resistant high yielding crop varieties. Use of pre-emergence herbicides should be encouraged for effective weed control. Adequate soil conservation measures are necessary along with terracing to reduce run off loss due to heavy soil erosion on hill slopes. Steps should be taken to extend production incentives, extension support, training, demonstration and proper marketing infrastructure. To overcome the problem of grain/fodder storage facilities and unavailability of quality fodder, silvi-pastoral and agro-forestry systems of farming should be promoted and storage facilities organised. In these areas there is extreme poverty and lack of awareness of modern technology. As such it is necessary to open up these areas by way of improved communication, provision of literacy/credit/input supply/subsides, etc.

Proper soil management practices through use of simple implements are necessary in sub-tropical valley as soils are difficult to work when wet. Scientific water management practices based on critical growth stages are also required. The soils should be tested and proper fertilizer management practices organized. Late submergence tolerant and early drought tolerant varieties of rice should be encouraged. There is impeded drainage during monsoon. Therefore, suitable drainage schedule should be developed along with water harvesting for supplemental use during post-rainy season. There is lack of quality fodder for livestock. This can be overcome by practising mixed farming including silvi-pastoral system for obtaining quality

fodder for livestock.

In mild-tropical hills also shifting cultivation is prevalent. It could be controlled by promotion of settled cultivation through proper land tenure system and terracing to reduce run off losses. Due to high pest and disease problem, plant protection measures should be organised timely and resistant varieties grown. There is low coverage of high yielding crop varieties in upland. This could be overcome by adoption of drought tolerant, short duration and disease resistant high yielding crop varieties. Pre-emergence herbicides are recommended for effective weed control. Adequate soil conservation measures and terracing to reduce run of losses are required to contain heavy soil erosion on slopes. Production incentives and extension support should also be extended. Problem of fodder shortage and unavailability of quality fodder could be solved by following silvi-pastoral and agro-forestry systems of farming. There is a need to promote communication, literacy, credit, input supply, and subsidies due to extreme poverty and lack of awareness.

The topography is generally undulating in mid-tropical plains. This could be managed by following appropriate soil and water management practices and cropping systems. Rock phosphate should be used due to low phosphate availability. Organic matter could be added in case soils are acidic. Drought tolerant short duration high yielding varieties may be adopted for uplands and medium tall, mid-late high yielding varieties for low lands. Generally there is lack of marketing facilities and agro-based industries. These should be developed. Sometimes areas are low lying and lands are marshy. In such cases, paddy-cum-fish-culture and growing of deep water rice could be adopted. Timely control of weeds should be encouraged through use of suitable chemicals. To overcome incidence of pests and diseases, timely plant protection measures particularly in case of rice are necessary.¹²

Except in Assam plains, in most of the hills in the North-East, population living in the areas belong to scheduled tribes. These tribes are in majority in Arunachal Pradesh, Meghalaya, Mizoram and Nagaland. Even in Assam plains, there is considerable tribal population. This population resides in clearly identifiable pockets where they are in majority. The population of scheduled tribes and their percentage distribution to total population in North-Eastern States in 1981 is given below:

<i>States</i>	<i>Persons</i>	<i>Percentage to total population</i>
Arunachal Pradesh	4,41,167	69.82
Manipur	3,87,977	27.30
Meghalaya	10,76,345	80.58
Mizoram	4,61,907	93.55
Nagaland	6,50,885	83.99
Sikkim	73,623	23.27
Tripura	5,83,924	228.44

Source: Census of India, 1981, India Paper-2 of 1984, General population and population of Scheduled Castes and Scheduled Tribes, Registrar General and Census Commissioner, India, New Delhi, 1984, pp. 6-7 and 13-17.

Land, the basic agricultural resource, is of great importance to scheduled tribes in view of the importance of agriculture to the scheduled tribes' economy. In the plains areas particularly those of Assam, Manipur and Tripura the process of alienation of lands of Scheduled Tribes to non-scheduled tribes has been going on for decades, but has accelerated after independence. The main reasons for alienation of lands are: (a) low agricultural productivity, lack of marketing facilities and consequent indebtedness, (b) absence of institutional credit facilities; (c) lacunae in laws and faulty implementation; (d) pressure on land from non-scheduled tribes immigrants (e) lack of comprehensive and up-to-date land records.

The mere existence of laws/regulations intended to check land alienation are not sufficient deterrents in themselves. The scheduled tribes are unable to effectively seek protection under the laws/regulations given their existing level of awareness and lack of capacity to engage in litigation. To detect cases of alienation of lands and set the law in motion a competent machinery needs to be set up. Further, there is need to simplify laws and procedures and cut proceedings in terms of both time and money. The lacunae in the laws need to be plugged. The survey settlement and updating of land records should be expedited and firm proof of land ownership placed in the hands of scheduled tribe land holders. This is necessary in the hill. The registration of transfers of land should be subject to clearance under the operative Act or Regulation. Deterrent punishment need to be meted out to non-scheduled tribes who continue to be in possession of scheduled tribes' lands despite orders of ejection.

Another problem which needs immediate attention is the problem

of indebtedness among the scheduled tribe population. It is a symptom of economic malaise. It is indicative of poverty at the household level. It reflects imbalance between income and minimum consumption requirements as well as lack of resources for carrying on gainful activity. Some of the reasons of indebtedness among scheduled tribes are: (a) abject poverty; (b) lack of awareness about sources of institutional finance and existing legal protection; (c) complicated lending procedures of banks/cooperatives and attitude of Government/bank officials; (d) lack of supply of essential commodities and agricultural inputs at fair prices; non-payment of fair prices for forest and agricultural produce; and (e) lack of employment opportunities.

Though most states have enacted laws to regulate the business of money lending and given debt relief, the enforcement of these protective laws is weak. Further, the powers vested in the Government under the Fifth Schedule to the Constitution have not been used to prevent exploitation by money lenders.

To overcome the situation, following measures are suggested: (a) enforcement of existing Acts/Regulations on money lending and debt relief; (b) establishment of institutional sources to displace credit at reasonable rates of interest; (c) streamlining of procedures for meeting requirement of both production and consumption credit; (d) encouragement of thrift among the scheduled tribes population and discouraging the drinking habit.

As regards problems in relation to improving agriculture in areas inhabited by scheduled tribe population important issues include the likely benefits to agriculture from induction of modern technology and impediments to introduction of such technology; promotion of indigenous inputs like organic manure, forest litter etc. in view of the high cost of inputs for modern agriculture; investment in irrigation sector particularly in minor irrigation; steps for prevention of alienation of the lands of scheduled tribe farmers consequent on large investments in minor irrigation and in the value of these lands; application of watershed development approach as a strategy for agricultural development particularly in dry land and hilly tracts; possible delivery system for extension services and inputs including credit; marketing arrangements; possible mix of food crops and high income cash crops; changes required in the organisation and operation of the public distribution system; choice between horticulture and plantation crops in view of the relatively long gestation period in case of later. A

comprehensive study on these issues would be required in each particular area.¹³

NOTES AND REFERENCES

1. Districts of Sonitpur, Darrang, Lakhimpur, Dhemaji.
2. District of Jorhat, Sibsagar, Golaghat, Dibrugarh, Tinsukia.
3. District of Nagaon and Morigaon.
4. Districts of Goalpara, Dhubri, Kokrajhar, Bongaigaon, Kamrup, Nalbari, Barpeta.
5. Districts of Cachar, Kakimangj and Hailakandi.
6. Districts of Karbi Anglong and North Cachar.
7. Tuensang, Zunenbhuto and Mokakchung in Nagaland; Tawang, Bomdila and West Kameng in Arunachal Pradesh, East Khasi Hills in Meghalaya; North Manipur and East Manipur; High altitude areas of Sikkim and parts of Mizoram.
8. Tirap in Arunachal Pradesh; Jaintia and West Garo Hills in Meghalaya, Nonghi Mangao and Gangtok in Sikkim, Parts of Mizoram except north and south, Kohima and Whoka in Nagaland.
9. Imphal in Manipur, Bhagti and Longnak in Nagaland and parts of Jaintia Hills in Meghalaya.
10. West Manipur, Jiribam and Rangpo in Sikkim, South Jaintia Hills and North Khasi Hills in Meghalaya, Dimapur and Ghaspani in Nagaland, Jampui in Tripura and North Mizoram.
11. Pasighat, Singpho and Lohit in Arunachal Pradesh, Dimapur in Nagaland and major parts of Tripura.
12. Singh, K.N. Bhattacharyya, H.C., Misra B.P. Ahlawat, I.P.S., Major crop production constraints and their remedial measures for different agro-climatic zones of India: 1988, Division of Agronomy, Indian Agricultural Research Institute, New Delhi, p. 189.
13. Background Papers, National Conference on problems of Scheduled Tribes: 1990 Ministry of Welfare (Tribal Development Division). Government of India, p. 36.

4

AGRICULTURE IN NORTH-EASTERN REGION— POTENTIALITIES, PROBLEMS AND STRATEGIES FOR DEVELOPMENT

S.N. GOSWAMI, B.K. SARMA, A.N. CHOUDHURY

The North-Eastern Region comprised of the states of Assam, Meghalaya, Manipur, Nagaland, Tripura, Arunachal Pradesh and Mizoram with a total area of 25.5 million hectare. The net area available for cultivation in the region is 6 million hectare representing 24 per cent of the total area. The net sown area in the region is little over 3.5 million hectare, which works out to 58.33 per cent of the total net area available for cultivation and the net irrigated area is 0.8 million hectare. The gross cropped area is 48 lakh hectare. The size of operational holding is very small being on an average within the range of 0.5 to 2 hectares.

The region is average characterised by high rainfall and humidity. The annual rainfall varies from 1200 to 5000 mm, although there are rain-shed belts also. Similarly, the relative humidity in the morning is usually above 80 per cent. Because of the wide range of altitude, ranging upto 5000 metres, the climate and so also the temperature range from tropical plains to temperate hills. The soil, which again ranges from new alluvial, old alluvial to lateritic, is in general rich in organic carbon, medium in phosphorus and medium to low in potash content. The pH of the soil is low ranging on an average from 4.5 to 5.5. The soil is usually high in iron content and very low or sometimes deficient in zinc, Boron and Calcium. These are, however, generalisations only. Sunshine hours are comparatively less during monsoon period from May to mid- September.

POTENTIALITIES

The potentialities of agriculture in the whole region are very vast. Besides, most of the food crops, fibre crops, etc. potentialities exist for growing a large number of other economic crops and plants. Rice, maize, wheat and ragi are important cereals while tuber crops, such as tapon, yams and sweet potato are very important crops, particularly for the hills. Potato, oil seeds—primarily mustered and sesame, sugarcane, jute, pulse crops such as black-gram, green-gram, pea, soybean, arhar and lentil are all important crops of the region. Besides the vegetables, many horticultural crops such as citrus, banana, pineapple, peach, plum, pears, apple, apricot and walnut, etc., can be successfully grown in different altitudes. Among the spices crops, ginger, turmeric, black pepper, cardamon and cinnamon hold great promise for development.

There are indigenous crops containing aromatic, medicinal and pesticidal properties, etc., in the region. Similarly, this region is also noted for the presence of various kinds of orchids. As a matter of fact, there are vast resources of plant materials which are indigenous to this region. It is known to be the primary source of origin of rice and may be the secondary source of the origin of maize. It is also the home of origin of many other crops and plants, such as mandarin oranges, phaseolus beans yams, brinjal, etc. wild and cultivated varieties of jute, cotton colocasia, etc. have already been collected. The genetic variability of the various crops, existing in the region, can be of immense value for improvement of crops all over the world.

There is great scope of developing agro-based industries in this region. The agro-industrial potentials of tea, jute, sugarcane; fruits, such as pineapple, oranges, peach and plum, citronella, etc. are already well-known. Coffee and rubber have also proved successful in the region. There are large number of other crops with potentialities for agro-based industries.

(i) The spices crops, such as ginger, turmeric, black-pepper, cardamom and cinnamon, not only grow well here but there is also immense scope for agro-based industries.

(ii) The tuber crops, such as tapioca, yams and sweet potatoes which are widely cultivated for food are very good sources for starch powder. Maize can also be used for the same purpose.

(iii) Banana, which grows abundantly in the whole region could be used for making banana powder used a food for babies and invalids.

(iv) The other crops with potentialities for industries are castor

for oil, ramie for fibre, fodder crops for hay as well as soybean for oil and feed.

Feed industries could come up from tapioca, maize, soybean etc. Pesticides and medicines could be developed for export purposes. Extension of Bromelin and citric-acid could also be taken up from pineapple wastes and citrus plants.

The potentialities of animal and fishes are also vast in the region. There is great scope for Animal Husbandry in the region, more specifically in the hills. The ecological conditions in some hill areas are comparable to those in Australia, New Zealand, Brazil, New Guinea and such other countries developed in Animal Husbandry Programme. Pig is, also however, by far the most important animal of the hill areas. Besides the usual livestock species, this region also possesses Mithun and Yak. Further, Arunachal Pradesh has the Himalayan sheep which is a very valuable animal for wool. Besides wild pig, wild fowls are also available in the region.

Although the scope for development of fisheries is very high in Assam, Tripura and Manipur, yet, the other regions also have very good potential for development of both captive and running water fishery. Further, there are a large number of indigenous fishes of the region which may provide answer for scientific development of fish culture in the hilly region. Mention may be made in this regard of important species of fish, such as Mahseer.

The community spirit existing among the tribal groups can also be the base for development of cooperatives. In many places, the land is owned by the community. Even the cultivation in *jhum* is done by the community as a whole. The high rainfall can also be converted into assets.

CONSTRAINTS IN THE PROCESS OF AGRICULTURAL DEVELOPMENT

The North-Eastern Region has its own peculiar problems that has hampered improvement of agriculture. For example, while acidic soil, high rainfall and humidity, low temperature during winter create problems that need to be solved through research, lack of irrigation facilities as well as lack of transport, communication and marketing facilities lead to infrastructural hindrances in the development of agriculture. Inadequate attention in the past has led to dearth of proper technology, non-utilization scientific inputs, tools and implements as well as dearth of technically qualified manpower. The old system of

shifting cultivation in the hills and the problem of flood in the plains are two other special problems of the region. In addition to the difficult terrain and inaccessible areas as well as problem of cultivation in the hills, socio-economic problems of various ethnic groups inhabiting the region and the varieties of dialects that they speak create problems in extension of technology. The land ownership pattern and absence of land records where improvement has been affected through wet rice cultivation, etc. in some of the areas are not conducive for providing the required incentives to the farmers, not only for practising improved technology, but also to have a stake in such improvement though the community decision regarding land allocation has many other advantages.

The problem of shifting or *jhum* (slash and burn) cultivation widely prevalent in the region has been the major constraint on agriculture production. As mentioned earlier, about 27 lakh ha. are subjected to *jhumming* engaging about 5 lakh families in the region. Of this area around 4.5 lakh is sown at any one point of time. This may be compared with the total net sown area of around 35 lakh ha. The problem is even worse if we exclude areas of settled cultivation like Assam and Tripura. If this is done, the area subject to *jhumming* is around 19.3 lakh ha. The areas sown at any one point of time is 3.6 lakh ha. and the corresponding net area sown around 6.2 lakh ha. Although it is not possible to immediately eliminate the system and wean away the farmers from the practices—it would yet to be necessary to give utmost stress to develop a phased-out programme to replace the system, ultimately with suitable alternatives, keeping in view the land use and management of water sheds. The ICAR research complex for this region has done considerable work in this direction which would be of help the States/Union Territories. This will succeed only if steps are also taken to ensure timely and proper supply of inputs like seeds, agro-chemicals, storage, marketing and credit and this is a major lacuna at present. Similarly, suitable training programmes will have to be organised for technical personnel at various levels to meet the requirement of specific areas and different farming systems.

STRATEGY FOR DEVELOPMENT

1. Scientific Land Use

Although Scientific land use is of vital importance yet it is not possible to wean away people from growing their staple food such as

rice even in areas/slopes where it not scientifically advisable to grow such crops. This is because

- (i) The farmer in these remote areas has no guarantee or the confidence that he will have regular supply of food round the year to feed his family, and
- (ii) Even if he grows some other potential crops it will take a number of years before its produce becomes marketable. Hence, he will require the supply of food by the time he can earn money to buy food by selling the marketable produce. Further, the development and organisation of the market in these rural areas are not proper to assure him a remunerative price. Even, sometimes there is no guarantee that he will have an assured market.

In view of this, steps are needed to ensure a regular supply of food and also to develop a proper marketing system before fully scientific land use can be advocated. The scientific land use for various areas will be different based on the conditions prevailing in the specific areas, such as hill-slopes, availability of sources of water, the soil depth and such other factors. As such a proper survey of the areas will be necessary to recommend the programme of proper scientific land use. Provision should be made for such appropriate survey.

2. Soil and Water Conservation

The following aspects need to be consider while advocating programme of soil and water conservation.

- (a) The on-going soil conservation projects need to be modified for effects implementations. The sense of involvements of the Tribal people and creation of confidence in the projects are very essential. Hence, programmes should be developed in consultation with the people and more particularly, the village leaders who are very important persons amongst the Tribal population. It is essential to develop an integrated programme on a village approach. Further, planning is essential to ensure very effective participation of all concerned development departments with an effective mechanism for co-ordination.
- (b) In many of the hilly areas deforestation in the catchment

areas have not only led to drying up of sources of water, it has also led to large scale soil erosion. Hence, afforestation of the catchment areas need to be taken up urgently.

- (c) There is great scope for water harvesting from the run-off to create water bodies for irrigation and fishery, etc. Technology is available for development of safe earthen bunds utilising indigenous resources which are economical and it is not essential to utilise cement and concrete bunds. Such programmes should be given priority as it will help in conserving Ecology as well as improving production.
- (d) Systems of farming suited to various conditions of topography hill slope and depths of soil, etc. should be advocated. Thus, Agricultural Farming system, horticulture system, agri-horticultural farming system, animal-based farming system, agro-forestry farming system and sylvi-pastoral or agri-horti-sylvi-pastoral system should be worked out depending on specific situations.

3. Horticultural Development

The potentialities for development of horticulture is very great in most of the hilly areas and this is more so in the North-Eastern hills where all kinds of horticultural crops can be grown in specific altitudes and where assured rainfall as well as rain-shed belts are available. However, alongwith development of horticultural crops, organisation of market and processing and preservation are very essential. Programmes can be taken to establish concentrate plants in interior areas in the centres of production, so that the same can be transported easily to some central areas for further processing and marketing. Pineapples as well as mandarin oranges can be specially developed in the North-Eastern region. The citrus plantation was suffering from a disease complex known as citrus decline, which is responsible for a great reduction in production of mandarin oranges. However, research carried out in the mean time, has led to identification of the causes of citrus decline and it is now possible to rejuvenate most of the declining orchards as well as to start new citrus plantations on scientific lines. Programmes need to be taken up in these aspects.

Spice crops, such as, ginger, turmeric, black pepper and tuber crops, such as, tapioca and colocasia can be developed immensely in the hill areas, establishing side by side agro-based proposed enterprises.

Various kinds of vegetables can be grown with profit in the region. In this connection, it may be mentioned that there is scope for raising cole crops in the region in both the seasons in the first crop in the low altitude areas and again the second crop in the high altitude areas. Similarly, winged bean can be grown very successfully. These aspects should be kept in view while developing strategies for production.

4. Agriculture

(a) Scientifically most of the agricultural crops should be grown in the foot-hills and plains, areas, specifically below 40 per cent slopes of the hills. It is felt that production of agricultural crops can be greatly enhanced, if there be provision for irrigation. The stress should, therefore, be laid to provide irrigation in the foot hills and plains areas, so that appropriate crop sequences can be taken up in these areas to make them self-sufficient in the matter of food crops.

(b) Wherever cultivation is done in terraces, the concept of topo-sequence should be kept in mind. In the higher terraces, crops which do not require enough moisture, such as, ragi and maize, etc. should be grown as the moisture regime will be poor in the upper terraces. Crops like rice which require abundant moisture in the field should be grown only in the lower terraces. Similarly, the terrace risers which constituted 37-40 per cent of the total area should be utilised for growing perennial fodder grasses and legumes as these will provide enough fodder to subsidiary sources of income through raising of animals, besides binding soil. Technology for growing fodders in terrace risers are also available.

(c) In many of the hilly areas, the period for which crops can be grown during the year is shorter because of low temperature for a considerable period of time. This limits multiple cropping. As such, the strategy for increased production in such areas should be mixed an inter-cropping. Such measures should be adopted for intensifying in these areas.

(d) Tools and Implements—Mechanisation of agriculture has not become popular in the hilly areas an utilization of large or medium machineries and tools are also not possible in many areas. However, there is a need to popularise small tools and implements that will take away the drudgery as well as economise the cost of production.

(e) It has been observed that availability of appropriate seed in time is a major bottleneck in agricultural production in the hilly areas.

Production of seed, should therefore be given priority. Programmes should be undertaken for seed production after identification of the varieties of seeds, appropriate to the areas.

(f) In many of the hilly areas, potato is a cash crops and production of seeds of varieties resistant to late blight should be taken up. While doing so, care should be taken not to introduce undesirable diseases like the wart disease.

5. Afforestation and Social Forestry

Importance of tree cover in the hilly areas for preservation of environment and ecology does not need any emphasis. However, in the programmes afforestation and social forestry, stress should be laid on fuel trees, fodder trees and preferably fuel-*cum*-fodder trees.

6. Programmes on Animal Husbandry

Animal Husbandry is one of the economical land-use system in the region. Although, Artificial Insemination programmes have been taken up extensively, health care and management have not received the attention it deserves. These two areas should be given special stress for development of Animal Husbandry programme. Similarly, availability of appropriate feed of reasonable price is again one of the major bottlenecks in the livestock and poultry production programmes. Steps should, therefore be taken to develop enterprises for feed production utilising locally available and cultivable crops. In areas where there is abundance of vegetable growth due to favourable climatic conditions and rainfall, programmes for growing fodders should be taken up on a large scale, so that there is increase dependance on mixed forages, rather than on feed concentrates to supply the total nutrition. This will not only help in making feeds cheaper, but also will have an economic conversion ratio for livestock products. Preservation of feed for the lean section through ensilage utilizing indigenous and cheaper methods should be popularised. Technology for such preservation of silage of common farmers are also available.

The housing normally advocated for the plains areas may not be either economics or suitable for the hilly regions. Stress should, therefore be laid on scientific housing suited to the hilly region and constructed to the extent possible utilising indigenous materials. This will help in popularising scientific housing in the remote areas also.

7. Special Programmes

Some of the special problems of the hilly areas related to specific situation are mentioned below:

(a) Shifting cultivation is widespread in the North-Eastern region, leading to not only low production, but also to adverse effects on soil erosion, floods, ecology and environment. This problem needs to be tackled with appropriate programmes. Alternative systems of farming should be advocated for areas where the cycle of shifting has come to six years or less. Integrated programmes can be taken up in such areas, besides having demonstration on alternative systems as compared to shifting cultivation.

Improvement of shifting cultivation in order to minimise soil loss and increase productivity should be taken up as a temporary measure in areas where the shifting cycle is more than six years. However, demonstrations on alternative systems should be taken up in such areas also for gradual winding away the farmers shifting cultivation.

(b) Socio-economic programmes: Socio-economic problems including the land tenure systems in some areas create problems in appropriate development. For example, in some areas of the North-Eastern hills region, the land belongs to the community or the village chief, who distributes various portions of the hill slopes to individual farmers for cultivation. In such a case, there is no incentives for the farmers to improve upon the land or even a permanent interest in the land. However, it is also not possible to develop technology for raising all kinds of crops that the farmer need the various portions/slopes of the same hill. Attention is, therefore, called for to sort out such problems in the interest of raising agricultural production.

(c) Dearth of technical manpower: It has been observed that there is a great dearth of technically qualified personnel in the hilly areas. In many cases, people from other areas are also not attracted to work and serve in these difficult areas. This has led to stagnation in proper growth. As well laid-out programme for development of technical manpower based on a realistic survey is therefore, very essential.

8. Centrally Sponsored Model Project

It has been stated earlier that there is a need to develop an integrated programme on a village approach for scientific land use and development of the area assuring optimum production with involvement of the people themselves. It would be desirable to develop a centrally sponsored programme for taking up model pilot project in

the hilly areas with an integrated approach.

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