Prioritization of Strategies for Agricultural Development in Northeastern India

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B C Barah

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Partnership

Prioritization of Strategies for Agricultural Development in Northeastern India

The workshop on *Prioritization of Strategies for Agricultural Development in Northeastern India* is a joint activity of three organizations:

1. **National Centre for Agricultural Economics and Policy Research, New Delhi**
2. **Assam Agricultural University, Jorhat, Assam**
3. **North Eastern Council, Govt. of India, Shillong, Meghalaya**

Foreword

The Northeastern (NE) India, comprising seven states, has been a hotspot of economic development both in socio-economic as well as geo-political spheres. Underdevelopment of Northeastern India threatens and further delays the developmental process. The region is endowed with green everywhere, but hardly any sign of green revolution is observed.

The classical theories of dependency, circular and cumulative causation and dualism are extremely relevant and useful to understand the process, although may not be adequate to explain the underdevelopment of the NE India. Perhaps, the neoclassical model of political economy might explain the process to an extent.

At present, there is a realization to intervene at the highest level for speedy socio-economic development of the region and thus is accorded the highest economic importance among the policy planners.

To give a big push, 10 per cent of Plan outlay of the central government has been earmarked for the NE India. We believe that there is no dearth of analysis, wisdom, vision, design and strategies for all-round development of the region. We are also of the opinion that transforming the development process of the Northeastern India from “despair to hope” is possible through a concerted efforts, in-depth analysis and effective policy perspectives. But, there is lack of programme prioritization, coordination and implementation.

The workshop, a joint initiative of the Northeastern Council, Shillong, Assam Agricultural University, Jorhat, Assam and the National Centre for Agricultural Economics and Policy Research, New Delhi, deliberated on various issues related to the agricultural development of the NE India. The eminent professionals including the policy planners, researchers and NGOs were invited to express their views. It is believed that the outcome of the workshop in terms of clear prioritization of the strategies for agricultural development would be useful to the policy makers as well as others interested in the development process. This publication, is the outcome of their contributions. The views expressed by the authors are not necessarily endorsed by NCAP or AAU or the NEC.

Dr B. C. Barah, Principal Scientist, NCAP has painstakingly edited and prepared the manuscript of this volume. Dr(Mrs.) Anuva Saikia, Head, Department of Agricultural Economics, Assam Agricultural University facilitated the collection of the materials for the volume. We are grateful to them.

Dr Mruthyunjaya
Director

Acronyms and Abbreviations

AAU	Assam Agricultural University
ADI	Agricultural Development Index
AERA	Agricultural Economics Review Association
AERC	Agro-economic Research Centre
AI	Artificial Insemination
ARIASP	Assam Rural Infrastructure and Agricultural Support Project
BOT	Build, Operate and Transfer
BVZ	Barrack Valley Zone
CAU	Central Agricultural University, Imphal
CBVZ	Central Brahmaputra Valley Zone
CMIE	Centre for Monitoring Indian Economy
CRRI	Central Rice Research Institute
DPAP	Drought prone Area Programme
DRDA	District Rural Development Agency
EPW	Economic and Political Weekly
FPAP	Flood prone Area Programme
FLBD	Frontline Block Demonstration
FMC	Farm Management Committee
GOI	Government of India
ha	Hectare
HDFC	Housing Development Finance Corporation
HZ	Hill Zone
HYV	High Yielding Variety
ICAR	Indian Council of Agricultural Research
IFPRI	International Food Policy Research Institute
INM	Integrated Nutrient Management
IPNM	Integrated Pest and Nutrient Management
IRDP	Integrated Rural Development Programme
LBVZ	Lower Brahmaputra Valley Zone
MFI	Micro Finance Institution
MSL	Mean Sea Level
NABARD	National Bank for Agriculture and Rural Development
NARP	National Agricultural Research Project

NBVZ	North Bank Valley Zone
NCAP	National Centre for Agricultural Economics and Policy Research
NEH	Northeastern Hill
NEI	Northeastern India
NEC	Northeastern Council
NIRD	National Institute of Rural Development
NSS	National Sample Survey
OKDISD	Omeo Kumar Das Institute of Social Studies and Development
PDC	Plastic Development Centre
PGR	Professional Grazing Reserve
PRA	Participatory Rural Appraisal
PSB	Phosphate Solubilising Bacteria
R&D	Research and Development
RARS	Regional Agricultural Research Station
RGVN	Rashtriya Gramin Vikas Nigam
RRB	Regional Rural Bank
SHG	Self-help group
SIDBI	Small Industries Development Bank of India
SKY	Special Kisan Yojana
SSP	Super Sulphate
UBVZ	Upper Brahmaputra Valley Zone
UNDP	United National Development Programme
VGR	Village Grazing Reserve
WALMI(NER)	Water and Land Management Institute (Northeastern Region)
WTO	World Trade Organisation

Acknowledgement

The Northeastern India is connected to the rest of the country by a narrow corridor surrounded by international boundaries and is subjected to isolation from the mainland activity. The index of agricultural and infrastructural development of the region ranks very poorly at the All-India comparison.

Of late, this developmental laggardness has drawn much attention from the policy makers and other concerned agencies at the national level.

The National Centre for Agricultural Economics and Policy Research (NCAP) has been investing on research initiatives in understanding the problems and prioritizing strategies for agricultural development in the region.

In this initiative, the NCAP organized a workshop on Prioritization of Strategies for Agricultural Development of Northeastern India. The need for such an activity was felt by NCAP during the tenure of Dr Dayanatha Jha, former Director, NCAP, who encouraged us to initiate the activity in the NE India. We are grateful to Dr Jha for promoting the activity in the early period. Dr P K Joshi, Principal Scientist, NCAP also took lot of interest in planning and organizing the workshop, which has benefited us immensely. He deserves our appreciation and gratitude.

Dr G L Kaul, Vice-Chancellor is a well-wisher of NCAP and showed lot of interest on the activity. He has kindly agreed to host the workshop at the Assam Agricultural University Jorhat. Dr Kaul along with his team has been instrumental in making the activity a success. We are grateful to Dr Kaul and thank all his staff members. Dr Anuva Saikia, Head, Department of Agricultural Economics, Assam Agricultural University, Jorhat acted as a crucial link between NCAP and the Assam Agricultural University to carry forward the activity from the beginning. Dr Anuva Saikia's organizational capability and academic contribution to the workshop is particularly appreciated. We would record our gratitude and appreciation to her.

Dr Mruthyunjaya, Director, NCAP, played an active role in making this initiative on policy dialogue a success. His leadership and participation in organizing and help in bringing out the proceedings is invaluable.

The North Eastern Council (NEC), Shillong, is a key organisation and a catalytic agent in facilitating the developmental initiative of the region. The

representatives of the NEC participated actively in the workshop, offered guidance for future activities. NEC's involvement has long-term implication in the development of the NER. The help and cooperation of Mr P L Thanga, IAS, Advisor Planning, NEC and Dr K P Das, consulting Advisor (Agriculture) NEC is highly acknowledged. The personal interventions of Mr P L Thanga, in guiding the deliberations during the workshop and pursuing the recommendations to develop Xth Five Year Plan proposal for the NE India is highly appreciable.

We are grateful to all the members, including the member secretary of the publication committee for their critical comments on the draft.

Finally, we are grateful to all the participants for their contributions and active role at the workshop.

B C Barah
Editor

Recommendations

Sluggish growth pattern and low-yielding agriculture in the Northeastern India depict a grim picture, making the regional food insecurity grievous in the face of sharply growing population. Hit by frequent natural disasters such as floods, high-low rainfall, increasing food deficit, low and unstable productivity in agriculture and livestock, the region poses serious development questions to the policy makers. Recent statistics show that the region is lagging behind in the context of poverty to catch up to the national average level at least by a decade.

Suggested Measures

Given the rich human capital and socio-cultural milieu, more concerted efforts are necessary to improve the future growth prospects and efficient utilization of untapped natural resources. It thus throws critical challenge to the policy makers to convert the weaknesses to strength for long-term sustainability in the region. Analysis suggests that the major explanatory factors beneath the dismal agricultural scenario are its total dependence on erratic rainfall, unpredictable and instable monsoon and low level of irrigation facilities. The management of land and water resources assumes enormous importance in improving the agricultural economy in the region. As the economic gains due to efficient land and water management in agriculture is quite substantial, systematic in-depth enquiry into the needed future strategies is of critical importance in the region. The gains due to irrigation can not be ignored,. particularly in the context of the emergence of water-needy Boro paddy. Floods have been creating great havoc regularly in the state. Since an immediate solution to complex flood problems is hard to come by, effort should be made to convert the problem to a prospect. To cope with the complexity of floods havoc, the flood escaping crop variety should be introduced. Early sowing of short-duration paddy and photosensitive variety, if available, may potentially escape the flood fury. The impact of flood should be evaluated in terms of social opportunity cost and benefits. Water management is emerging as crucial in the region both for drinking as well as for agriculture purposes. The measures for efficient resource utilization should be a mix of short run measures to get rid of flood damages and long run measures to optimally utilize the resource for irrigation and power benefits. A necessary pre-requisite for effective utilization of huge untapped production potential of diverse cropping systems, is to ensure adequate incentive structure. The market research and suitable market development is essential.

Among the other strategies to combat developmental distortions include the following:

I Technology Related

1) As a first step, flood map, irrigation map, rainfall map and prevailing cropping pattern map of the states should be made available.

2) Since the flood period covers the kharif and summer crops, the cropping pattern in the flood-prone areas should be changed to encourage the rabi crops. The promotion of these alternative measures necessitates efficient supplementary irrigation facilities. As an insurance against the weather uncertainty, scope for supplementary irrigation in rabi crops may be widened.

3) Alternatively, whenever feasible, deep water crops like Bao paddy may be promoted in flood-prone and low-lying areas. These flood-resistant crops have naturally elongated stems to keep the foliage above water. Therefore, these crops must be lodging resistant. Hence, appropriate technology development requires serious attention.

4) Research on developing appropriate crop sequence on farming system approach rather than cropping system should be aimed with a view to escape or compensate for flood damages/losses. Horticultural crops, value-added tree planting, fruits and grasses may be grown in the catchment areas of the river so as to maximize the returns not only to household but also to get the social gains. Because such crop coverage protects soil erosion and river inundation to a great extent.

5) The provision of insurance of crops, cattle, livestock, poultry and fishery in the floods-prone areas could provide security to the affected farmers.

6) Reclamation of the degraded and problem soil for the purposes of agriculture with assured provision of the protection of ecological standard for ensuring sustainability.

7) In the Flood prone areas, the government should introduce programmes like Flood-prone Development Programme (FPDP) towards overall development of the affected areas. In

the line of programmes like Drought-prone Area Programme (DPAP) in the dry region, and Integrated Desert Development Programme in the deserts.

8) Since the region has enormous water resources, its development initiatives could be linked to integrated water development projects like storage structures, irrigation, power generation, fish-culture, tourism, etc. The huge investment need for such initiative should come forth from state government, central initiatives including international assistance.

The critical priorities for accelerated development of NE states are identified after a detailed deliberation at the National Workshop. These are suggested to be pursued vigorously and should receive highest attention in the Five-Year Plan for the NER.

II Specific Researchable Issues

1) Rabi fallow and waste land utilization
2) Boro rice
3) Breeding cold tolerant rice varieties and rice varieties for high altitude
4) Rainfed upland rice/direct seed/transplanted “ahu” rice
5) Wheat in *rabi* with emphasis on developing short-duration HYV
6) Short-and long-term impact of the shallow tubewell (STW) programme on soil health, crop productivity, environment, etc.
7) Crop diversification for economic utilization of irrigation water through STW
8) Rain water (Watershed) management
9) Improvement in ‘Jhum’ cultivation
10) Animal disease forecasting
11) Feed from conventional sources
12) Post-harvest management of horticultural/animal/fishery products

Action: [AAU, Jorhat, CRRI (Gerua), ICAR Research Complex, Barapani, CAU, Imphal, WALMI (NER), NEC]

III Extension/Developmental Issues

1) Boro rice
2) Watershed development
3) Micro-irrigation/sprinkler
4) Value-addition to 'Ahu' rice for making beaten rice and rice bran oil
5) Commercialization of processed maize product (Popcorn) and rice through post-harvest management/value-addition
6) Strengthening research-extension-farmer (REF) linkage
7) Use of plastic in special reference to off-season crops

Action: **[Development Departments of the Govts. of NER, NEC]**

IV Development (Supplies and Services) Issues

1) Supply of seeds/planting materials/ feeds/ animals/ vaccine/ soil testing/ agricultural extension/ credit/market facilities/ market information
2) Promotion of allied enterprises/activities (Beekeeping, rural crafts, sericulture, mushroom production, floriculture etc.)
3) Development of appropriate rural infrastructures

Action: **[Development Departments of the Govts. of NER, NEC]**

V Socio-economic and Policy Research Issues

1) Land reforms
2) Market reforms
3) Backward and forward linkages with corporate/plantation agriculture
4) Peoples Institutions: Traditional knowledge, self-help groups, farm management committee, shifting cultivation (impact analysis of *Jhum* control scheme), medicinal and aromatic plants
5) Micro-irrigation: Problems and prospects
6) Economic evaluation of watersheds

7) WTO and agriculture of the NE states

8) Land use restrictions

Action: [AAU (Jorhat), AERC, Jorhat, NCAP, Delhi, ICAR Research Complex, Barapani, OKDISS, CAU, Imphal, NIRD, Gauhati]

Follow-up

1) There would be Steering Committee and Core Working Group
2) NEC will co-ordinate the activities
3) There would be half-yearly meeting of the Core Working Group
4) State governments of NER will reprioritize these issues and implement them
5) A meeting will be called in April by NEC to discuss and decide on the future course of action
6) The prioritized issues will be circulated among all the NES and all others concerned and they will be participating in the April meeting.
7) State governments of NER will prepare their own policy documents for agricultural development.

1 NORTHEASTERN INDIA : STRATEGIES FOR AGRICULTURAL DEVELOPMENT- AN OVERVIEW

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National Centre for Agricultural Economics and Policy Research, New Delhi

The Northeastern India is a chicken-necked region, connected to the mainland with a narrow corridor and surrounded by international boundaries of Bangladesh and Bhutan. This unique characteristic adversely affects the economy and other regional factors, such as a sense of isolation, remoteness etc. Northeastern India consists of Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim covering 255.08 million hectares, which is about 8 per cent of country's land mass. More than 64 per cent of the total geographical area is covered by thick and deciduous forest (164.101 million hectares under forest). Except a small valley plain of about 30 per cent, the rest of about 70 per cent of the total area is hilly and mountainous track of very steep to moderate slope. Thirty per cent of valley plain consists of upland, lowland, deep water and very deep water ecological situation. The region is highly diverse in terms of agro-eco-system, socio-cultural mixture of the people, a blend of multiplicity of ethnicity and geo-topographical variability. Average rainfall in the region is the highest in the country. The renowned agricultural scientist Dr M S Swaminathan describes the region as a cultural and genetic paradise and granary of mega biodiversity in terms of flora and fauna as well as micro-flora and micro-fauna. Despite richness in natural endowment, the NEI is the most backward areas of the country, home for a very high proportion of the poor, agriculture is highly risky and productivity is low. The crucial message is that the abundant and rich natural resources are neglected in the past but must put to efficient use now to catalyse the developmental process. In the absence of concerted efforts, the state is unable to provide necessary support system to manage these resources for the benefit of the people. Rather than conserving biodiversity, the stock of the biological resources are fast dwindling and making the social life devoid of harmony and lack of coexistence. Large stock of natural resources, abundant water resources, number of perennial river systems and the precious human capital are actually wasted. As a result, the region suffers from drought situation even during monsoon season on one hand and frequent floods inundating vast plain areas on the other hand. Under the circumstances, if resources are not properly developed and managed, the food security in the predominantly agrarian economy will be endangered. Flood causes loss of crops, lives

and properties regularly and its occurrences are increasing. Therefore, the missing policy link between effective supporting infrastructure, coordination and implementation of the developmental schemes is a major cause of concern requiring urgent attention.

Total population in the Northeastern India is 31.547 million with density of population varying from as low as 10 persons per sq. kilometre in Arunachal Pradesh to 286 persons in Assam. Assam is the most densely populated area. Relatively favourable land-man ratio indicates that there exists vast scope for efficient utilization of the land resource. The quality of land and water resource is extremely favourable to agriculture-forestry-livestock system. The rate of growth of population in the region is generally higher than at the national level but uneven across the states. It ranges from a low of 2.17 per cent in Assam to the high of 4.45 per cent in Nagaland during the period 1981-1991. The Census 2001 also shows identical trend. The per cent decadal change of population continues to be low at 19 per cent in Assam and the highest of 64 per cent in Nagaland. The tribal population is very high ranging from 20 per cent in Assam to 90 per cent in Manipur. Thus, under the peculiar composition of the population, rather than ignoring, the socio-economic, political and cultural diversity should form the basis of regional planning.

Poverty is extremely rampant in the Northeast. The proportion of population below poverty line (BPL) in the year 2000 was reported at 33.47 per cent in Arunachal Pradesh, 36.09 per cent in Assam, 28.54 per cent in Manipur, 33.87 per cent in Meghalaya, 19.47 per cent in Mizoram and 34.44 per cent in Tripura. Except Mizoram, the BPL ratios in all other states exceed the All-India level of 26.10 per cent (NSSO 2000). The most intriguing fact is that the BPL statistics shows that the region is lagging behind the national level by over a decade. The contribution of agriculture to the state domestic product is not substantial and its growth also low. The State Domestic Product at current price in 1995-96 is Rs 15,553 crore in Assam, Rs 1,557 crore in Tripura, Rs 1,442 crore in Nagaland, Rs 1,590 crore in Meghalaya, Rs 1,412 crore in Manipur, Rs 1,093 crore in Arunachal Pradesh and Rs 761 crore in Mizoram.

The quality of land in the region is favourable for a wider range of crops-livestock-forestry-fishery activities. The proportion of area under forest is also favourable with a high per cent of 89.1 in Mizoram to 30.4 per cent in Assam. It indicates that there is need for an effective forestry development strategy for creating synergy between agriculture and forestry sector. Net cropped area of 3.722 million hectares is cultivated by 54.83 lakh cultivators. It gives the population:cultivator ratio of 5.75:1, whereas the number of people dependent on agriculture is over 86 per cent. The total number of operational holdings is 34.92 lakhs but majority of them are small in size.

By and large production condition in agriculture is traditional. The agricultural productivity is the lowest, irrigation facility almost non-existent in many of the areas and consumption of fertilizer is extremely low in the region. The lowest consumption of NPK is observed in Arunachal Pradesh at 2.2 kg/ha and the highest of 48.3 kg/ha in Manipur during 1997-98. The adoption of high-yielding varieties is also sluggish. The area under HYV paddy was 1,422 thousand hectares in Assam, 223 thousand in Tripura, 72 thousand in Manipur, 42 thousand in Meghalaya, 35 thousand in Arunachal Pradesh and only 2.0 thousand hectares in Nagaland in the year 1996-97. In case of other crops, the adoption rate is much lower. These statistics show a pessimistic scenario of the current status of agricultural development in the region. However, it also sets the basis of strategies for future planning perspectives.

Rice is the major crop in the region. The compound growth rate of rice area is 1.68% and of production is 2.95 per cent. Total area under rice is 33.97 lakh hectares varying from 43.09 per cent of gross sown area in Meghalaya to 84.97 per cent in Manipur. The total production of rice is 48.48 lakh tonnes and the average yield is 1,427 kg/ha. The decadal analysis shows that the low growth rate of rice area, production and productivity during the 1970s was improved in the next decade. But unfortunately, the improved performance could not be sustained. After reaching the highest peak in 1980s, the performance in the sector declined during 1990s not only for rice, but for all the crops. This is apparently an alarming signal for the long-term sustainability of the crucial agricultural activity in the region. Significantly, the growth of area and production in the post green revolution period (1981-1998) has already declined to below those of the green revolution period. However, the silver line is that growth of productivity shows encouraging sign in the recent period. But a most relevant question in the changing scenario is that why the average performance of agriculture is far behind the national average level, not to speak of the best performing state.

The demand and supply equation shows that demand for food out strips the production and the gap is increasing over time. It is estimated that the current deficit of 9.08 lakh tonnes of rice in Assam (for example), would increase to 14.73 lakh tonnes in 2010. The deficit of wheat would be 0.74 lakh tonnes, Maize 0.47 lakh tonnes and of pulses 1.82 lakh tonnes. There will be 1.70 lakh tonnes of deficit in oilseeds in Assam in the next decade. The story is similar or worst in other states.

The current situation in the most populous and largest state, namely Assam is grim and deteriorating, which has wider implication in the entire region. The per capita agricultural income in Assam is Rs 1,741 (at current price), net area under cultivation is 35.54 per cent of total area, only 15 per cent of

net cropped area and less than 10 per cent of rice area is irrigated, area under HYV of all crops is 39.09 per cent and that of rice is 43 per cent. The fertilizer consumption is as low as 10.50 kg/ha and the cropping intensity is 140 per cent. It thus, implies the need for policy imperatives for enhancing production by inducting appropriate technology and necessary institutional change along with good governance.

Most disturbing fact is that if the present scenario of adoption of agricultural technology continue, it will be difficult to catch up with required rate of productivity to meet the demand of food arising from the growing population. The existing yield gap between potential yield and average yield is 72 per cent in autumn rice, 62 per cent in winter rice and 68 per cent in summer rice and about 43 per cent in case of oilseeds. In order to achieve self-sufficiency in foodgrains in 2010, the required yield rates in Assam are estimated as 2.6, 2.5, 5.0, 1.8 and 1.3 tonnes/ha for paddy, wheat, maize, pulses and oilseeds respectively. These targets are easily achievable if necessary policy support systems gear up to bridge the gaps.

The general production condition in the region is favourable for plantation crops. Among the plantation crops, the cultivation of tea, rubber and coffee are of the most commercial/corporate significance. Total area under tea is the highest in the country at 2.36 lakh hectares, producing over 55 per cent of total production 4.33 lakh tonnes. At present, the area under rubber of 44.72 thousand hectares produces about 9,780 tonnes. The total area under coffee is 10.1 thousand hectares. The soils are also suitable for cultivation of a number of fruit crops such as jackfruit, arecanut, mango, orange etc, which are commonly grown but mostly for home consumption and sustenance purposes.

Livestock is an integral part of the regional economy. A variety of livestock are available in the entire region. The land-man-livestock ratio in the region is higher than the same in the national level. However, most livestock are of non-descript type and the yield rate is low. Thus not only the milk and milk products but also the meat and meat products are in short supply in the region.

The shifting cultivation is one of the common practices followed particularly in the hill areas. Shifting cultivation locally known as *Jhum* system has several unique features of the cultivation in hilly areas of northeast India. At present, it covers as much as 14,660 square kilometres providing livelihood to 4.44 lakh jhumia families. The virtues of the system include, a long evolution process over the ages, employs the local knowledge and judgement for efficient management of natural resources. It is a slash and burn method of cultivating an admixture of crops continuously for a couple of years. Use of external inputs is minimal in *Jhum* and hence is a model of

pure organic farming system. It also uses minimum tillage and less or no inputs besides being an eco-friendly system. The system provides not only the cereals but also enough of livelihood opportunities to satisfy the overall household food security. Most importantly, it provides a continuum stream of income generation. The management of the system is also highly participatory symbolizing a model of collective action. On the judgement of the community, if the system is not yielding enough to meet their requirement, then the field is abandoned and the cultivators move to newer areas, but return to the same area after a reasonable *jhum* cycle of about 5-10 years. Of course, the *jhum* cycle at present has reduced to less than 2-3 years primarily on account of population pressure.

Major Constraints

Sluggish growth pattern and low-yielding agriculture in the region depict extremely grim future, making food insecurity most grievous in the face of sharply growing population. Hit by frequent natural disasters such as floods, high-low rainfall, increasing food deficits, low and unstable productivity in agriculture and livestock, the region poses a serious development question to the policy makers. Access to institutional and infrastructure support (including effective delivery system and credit institutions), lack of people's participation in the development process and management have been the inhibiting factors for development. The emergence of self-help groups, in this context, could potentially ease the credit problems to a great extent if properly promoted.

Given the rich human capital and socio-cultural milieu, more concerted efforts are necessary to improve the future growth prospects and efficient utilization of untapped natural resources. It thus throws critical challenge to the policy makers to convert the weaknesses to strength for attaining long-term sustainability in the region. Analysis suggests that the major explanatory factors beneath the dismal agricultural scenario are its total dependence on erratic rainfall, unpredictable and variable monsoon, low level of irrigation facilities and inadequate crucial infrastructure support system including efficient R&D back up services. The management of land and water resources assumes enormous importance in improving the agricultural economy in the region. As the economic gains due to efficient land and water management in agriculture is quite substantial, systematic in-depth study on the status and future strategies is of prime importance in the region. The gains due to irrigation cannot be ignored, particularly in the context of the emergence of water needy *Boro* paddy. Floods have been creating great havoc regularly. Since an immediate solution to complex flood problems is hard to come by, effort should be made to convert the problem to a prospect. To cope with the floods havoc, the flood-escaping crop varieties should be introduced. Early sowing short-duration paddy,

photosensitive varieties, if available, could help escape the flood fury. The impact of flood should be evaluated in terms of social opportunity cost and benefits. The overlay of the flood map, irrigation map, rainfall pattern and the cropping pattern maps provide a focused policy strategy in the geographical dimension. It is also argued that as an insurance against the uncertainty of weather and flood havoc, the promotion of short-duration *rabi* crops and supplementary irrigation facility would help escaping the flood fury. Among the measures for efficient resource utilization include a mix of short run measures to get rid of flood damages and long-term measures to optimally utilize the resource through efficient infrastructure support system. For example, the productivity performance of deep water crops like *bao* paddy in flood-prone and low-lying areas should be improved through effective R&D initiative. The *bao* paddy has excellent flood resistance property and naturally elongated stem to keep the foliage above water. It is no denying that the efficient infrastructure is the base of future growth prospects, which is presently highly inadequate. The magnitude of capital requirement for building the infrastructures particularly in the diverse topographical situation, is unparallel and extremely high. Thus the process requires careful and long-term strategies.

Keeping in view the numerous constraints (elaborated inside), the critical priorities for accelerated agricultural development of the NE states are identified after a detailed deliberation at the National Workshop. The proceeding of the workshop is divided into four sections. The first section presents a report of the status of economy, particularly the agricultural sector (agriculture, horticulture, plantation crops, livestock and fisheries), identify and prioritization of the constraints, second section takes a stock of technology and future prospects for agricultural economy, the third section discusses the emerging institutional reforms and future needs and finally a conscientious recommendations are formulated. These are suggested to be pursued vigorously, particularly should receive highest attention in the X Five-Year Plan for the NER.

Specific Researchable Issues

1) *Rabi* fallow and waste land utilization

2) *Boro* rice

3) Breeding cold-tolerant rice varieties and rice varieties for high altitude

4) Rainfed upland rice/direct seed/transplanted "*ahu*" rice

5) Wheat in *rabi* with emphasis on developing short duration HYV

6) Short-and long-term impact of the shallow tubewell (STW) programme on soil health, crop productivity, environment etc.

7) Crop diversification for economic utilization of irrigation water through STW

8) Rain water (Watershed) management
9) Improvement in *'Jhum'* cultivation
10) Animal disease forecasting
11) Feed from conventional sources
12) Post-harvest management of horticultural/animal/fishery products

Extension/Developmental Issues

1) *Boro* rice
2) Watershed development
3) Micro-irrigation/Sprinkler
4) Value-addition to *'Ahu'* rice for making beaten rice and ricebran oil
5) Commercialization of processed maize product (Popcorn) and rice through post-harvest management/value-addition
6) Strengthening Research-extension-farmer (REF) linkage
7) Use of plastic in special reference to off-season crops

Development (Supplies And Services) Issues

1) Supply of seeds/planting materials/feeds/animals/vaccine/soil testing/ agricultural extension/credit/market facilities/market information
2) Promotion of allied enterprises/activities (Beekeeping, rural crafts, sericulture, mushroom production, floriculture etc.)
3) Development of appropriate rural infrastructures

Policy Research Issues

1) Land reforms
2) Market reforms
3) Backward and forward linkages with corporate/plantation agriculture
4) Peoples Institutions: Traditional knowledge, self-help groups, farm management committee (FMC), shifting cultivation (impact analysis of *Jhum* control scheme), medicinal and aromatic plants
5) Micro-irrigation: Problems and prospects
6) Economic evaluation of watersheds
7) WTO and agriculture of the NE states
8) Land use restrictions

2 PRIORITIZATION OF STRATEGIES FOR AGRICULTURAL DEVELOPMENT IN THE NORTHEASTERN INDIA: A SYNOPTIC OVERVIEW[1]

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Introduction

Northeastern India, comprising the states of Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland, and Tripura is a hot spot of Indian Economic Development. Some even state that underdevelopment of northeastern India is caused by development of advanced areas. Further, the region is also riven by prolonged and multiple insurgencies highlighting national security importance of the region. In general, the region is green everywhere, but no green revolution. Many theories have been advanced to explain the underdevelopment of NE region. For instance, they include, dependency theory, circular and cumulative causation, dualism and export-growth model. These theories are useful, but not adequate. The neoclassical political economy theory, which seems to be somewhat relevant explains underdevelopment in terms of optimization of goals of lobbies and interest groups and welfarish approach, neglecting the long-term growth path.

It is welcome that at present, there is a strong realization to intervene for the all-round development of northeastern India at the highest level. To give a big push, 10 per cent of central plan outlay is also earmarked for NE India indicating higher availability of increased resources for development. This calls for a definite plan and a strategy for development. The existing literature on analysis, wisdom, vision, design and strategies suggest that transforming development of northeastern India from “despair to hope” is possible. But, there is lack of programme prioritization, integration and implementation. The present seminar is a step in that direction.

This overview briefly presents the main constraints for development of the region and, a framework of SWOT analysis for the region and the road map for accelerated development of the region.

[1] Some of the points used in the paper are based on the draft report of the “Committee on remedying agricultural progress in the backward areas” under the chairmanship of Dr M S Swaminathan.

Emerging Scenario in Indian Agriculture

The constraints to development of the region which are examined under four heads as follows:

Socio-cultural: Rapid population growth, high population density, and tribal to non-tribal composition, shyness of the people, shortage of technical manpower, lack of skilled agricultural work force, inappropriate land tenure system, private property rights in hill areas, insurgency and ineffective governance etc.

Physical: Hill topography, land-lock characteristics, primitive agro-economic system, high rainfall and its skewed distribution, frequent floods, fragile ecology, unsuitable cropping pattern, shifting cultivation, fragmented holdings, soil degradation, poor development of fishery, livestock and forestry etc.

Technological: Underdeveloped irrigation facility, poor or non-adoption of HYVs and fertilizers, absence of agro-processing industries, lack of sound disaster warning system, soil testing facilities, viable fishery and livestock technologies, high risk and uncertainty in *kharif* season

Infrastructure: Very poor and inadequate road and communication network, markets, transport (rail, road, air and water including total lack of sea route), banking and other financial institutions, low investment on health, education and rural electrification, absence of private sector participation in the development process, lack of skill and enterprises in the region etc.

Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis

In order to get greater insights into the development paradigms in the region, a framework of SWOT analysis is attempted.

Strengths

Water: Numerous rivers, streams, and other water bodies with perennial flow of water in the region, potential for irrigation, hydropower, water transport, fishery etc.

Tea: Climate-topographical situation is most suitable. Fifty-six per cent of India's tea production in the region, most of which is organically grown.

Oil and petroleum products: Over half of oil and natural gas production of the country is in the northeast region (NER).

Forests: The region possesses richest bio-diversity, good quality usable wood / timber

Potential international markets for exports and imports: The NER is surrounded in all sides with international borders

Mineral resources: Several mineral resources are found in abundance

Weaknesses

Isolation: from the main land and shyness of the people

Socio-cultural closeness: (particularly of the tribal), subgroups, multiplicity of ethnic groups, diversity of language and dialects etc.

Shifting cultivation: Though labeled as inefficient, shifting cultivation is a major mode of production in many areas, 16 per cent of the available land area involving 4.5 lakh *Jhumia* families. Due to population pressure, the Jhum cycle is reduced which is a deterrent to local ecosystem

Lack of capital formation: Outside markets for trading the natural resources of the region are in existence from colonial regimes. But the market is unidirectional, inefficient and does not favour capital formation

Movement of flow of men and material: Due to various reasons, the flow of man and material is highly limited

Lack of data-base: Lack of relevant on information on socio-economic and development parameters, is a policy deterrent

Opportunities

Potential international market: Triangular and quadrangular trade can be promoted

Close society: Better socio-cultural exchange in tribal societies; a model of collective action

Diversification: Agro-based industries using the local raw materials-horticulture, fishery, tea, rubber, jute, oilseed etc.

Threats

Ecological: Floods, cyclone and earthquakes occur frequently

International border: Long and difficult terrain in the international border

Social Security: *Possibilities for border-crossing creating situations of threat to social/national security*

The Road Ahead – Strategies

The strategies are suggested based on constraints and SWOT analysis keeping in view the basic tenets of interdisciplinarity, eco-regional

perspective, making business with a changing attitude, and with strong O&M motivation. The principles involved include ecology, gender and social equity, economics and employment.

The components of the strategy include:

Technology Policy: Conservation of biodiversity, integrated farming system approach, soil conservation, soil health care, sustainable land use, rain water harvesting and conservation, watershed development, groundwater utilization, energy management, IPM, demand-driven identification of crop, livestock, tree and fish enterprises of the farming system, efficient post-harvest management including producer oriented marketing and promotion of non-farm rural enterprises and knowledge, skill, information and management improvement / upgradation.

Socio-economic and policy: Thrusts on land reform, institutional reform, marketing, transport, communications, energy, industry, handloom and handicrafts, trade and transit, tourism, banking and finance and effective governance.

It is felt that the right mechanism is to implement the strategies of the Eco-regional Technology Mission as suggested by Swaminathan (Table 1)

Conclusion

NE India is a hotspot for Indian economic development. Analysis, wisdom, vision, plan, strategies, mechanism, resources exist programme prioritization, integration and implementation is lacking. This can easily be addressed, if the suggested strategies are implemented using the eco-regional technology mission suggested by Swaminathan (1996).

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Table 1: Mechanism: Eco-regional Technology Mission

Research Education and Extension	Ongoing Technology Missions	Boards	Department Programmes	Financial Institutions	Democratic Structures Including NGOs	Mass Media
Agricultural Universities	Oilseeds	National Dairy Development Board	Agriculture Animal Husbandry Fisheries	NABARD	Panchayats	Electronic Printed
ICAR and CSIR Institutions	Pulses	National Horticulture Development Board	Forestry, Rural Development and Wasteland Development	Lead Bank	Civil Society	
Rural and Women's Universities	Maize	Silk Board	Irrigation and Watershed Development	Cooperatives and Land Development Banks		
IITs	Drinking water	Coffee, Rubber, Tea and Spices Boards	Ground Water Board Cooperation			
Krishi Vigyan Kendras	Literacy		Marketing			

Source: M.S. Swaminathan Committee Report, 1996, op cit

3 PERFORMANCE OF AGRICULTURAL ECONOMY OF THE NORTHEASTERN INDIA: CONSTRAINTS AND PRIORITIES

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The seven states of Northeastern India, comprising Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland and Tripura cover 255.09 lakh hectares, which is 7.76 per cent of total land area of the country. The region has unique distinction of having diverse hill ecosystems covering more than two-third of total geographical area. The hill areas have wide range of altitude upto 5,000 metres. The riverine plains, swamps, *tilla* land and char areas are the other agro-ecological situations. The region receives abundant rainfall with the world's highest rainfall of 12,000 mm at Mawsynram in Meghalaya, in one hand and the rain shadow belt in Nagaon district of Assam with ± 1,200 mm rainfall, on the other hand.

The N.E. hills cover Karbi Anglong and N.C. Hills of Assam, entire territories of Arunachal Pradesh, Nagaland and Meghalaya with per humid to humid climate receiving 3,528 mm rainfall annually. Nearly 94 per cent of land in Arunachal Pradesh and about half in Nagaland and Meghalaya are under forests. The hill regions of Manipur, Tripura and Mizoram receive 2,052 mm rains and the climate is to humid. The soil is acidic. Most of the land in Manipur is barren and considered unculturable. The plains of Brahmaputra and Barak Valleys of Assam receive 2,800 mm average rainfall with uneven distribution. The climate is per humid to humid.

Agriculture is the dominant economic activity providing employment to 64.28 per cent of total workers. The region has 3.73 per cent of the total population of the country and contributes 2.6 per cent to the Net Domestic Product.

Land Holding Pattern

Total operational land in the N.E. India is 53.4 lakh ha. The highest operated area is 31.6 lakh ha in Assam and the lowest (0.8 lakh ha) is in Mizoram. Nagaland has the unique characteristic of highest size of operational holdings at 6.8 ha, which is higher than the Northeast regional average (1.59 ha) and also of the all-India level (1.6 ha).

Land Utilization Pattern

Out of total geographical area of 255.09 lakh ha in the NE India, area under forest is 164.3 lakh ha (64 per cent). Arunachal Pradesh has the highest area (93.79 per cent) under forests followed by Mizoram (61.98 per cent). In Manipur forest area is sharply declining. Net sown area (NSA) in the region has increased from 31.61 lakh ha in 1977 to 38.05 lakh ha in 1995-96. The proportion of net sown area to total area is as low as 15 per cent as against 46.6 per cent for all-India average. Although the monocropped area dominates the region, the gross cropped area has increased from 39.41 lakh ha to 54.3 lakh ha due to newer area under cultivation and introduction of newer crops. There are a few exceptions like Arunachal Pradesh and Mizoram, where only 2.68 per cent and 3.09 per cent of the total reporting area are respectively cultivated, primarily on account of adverse conditions, difficult terrains and barren land. The cropped area in Manipur, Meghalaya and Nagaland is 8.32, 9.02 and 12.40 per cent respectively.

Shifting Cultivation

In the Northeastern India more than two-third of total geographical area is covered by hills. Shifting cultivation (*Jhum* cultivation) is the common practice in the hills. About 4.43 lakh families solely depend on shifting cultivation. The practice of *jhum* has been undergoing rapid changes particularly in the recent times. *Jhum* cycle declined from 3 to 10 years to 2-3 years. Since the *jhum* system has a number of merits, declining *jhum* cycle would have serious adverse implication to the poor. The strategy for *Jhum* improvisation in tune with socio-cultural milieu would benefit the society. Among the alternative methods of improvement include adoption of improved cultural practice, planting perennial crops, control of soil erosion, encouraging allied agricultural activities. Few on-going programmes for promoting and improvisation of *jhum* are listed below.

1) Permanent settlement of Jhumia cultivators through development of plantation crops in Karbi Anglong and N.C.Hills of Assam,

2) Providing 2.0 ha of terrace land to Jhumia family along with inputs and financial help for permanent cultivation in Meghalaya

3) Pilot project on land reclamation, minor irrigation, land improvement, provision of seeds, fertilizers and development of horticulture and cash crops in Mizoram

4) Pilot projects in Nagaland induced farmers to give up *Jhum* cultivation and adopt terrace cultivation.

These schemes however, require economic impact evaluation and improvisation where necessary.

Changes in Cropping Pattern

Rice is the main crop in the N.E. states covering around 61 per cent of gross cropped area. Manipur has the highest proportionate rice area (76.38 per cent) while Meghalaya (43.09 per cent) and Arunachal Pradesh (45.73 per cent) have comparatively lower area under rice. Jute is grown mainly in Assam, Meghalaya and Tripura. The cultivation of maize is concentrated in the hill states. The total area under oilseeds covers around 8 per cent of gross cropped area. Wheat is relatively a new crop in Assam and Meghalaya. Sugarcane is another cash crop grown in all the N.E. states except Arunachal Pradesh.

The salient features of cropping pattern are as follows:

1) The area under rice has declined from 73.97 per cent in 1977 to 62.63 per cent in 1991 in Assam, 74.44 per cent to 53.91 per cent in Tripura, remained stagnant at around 80 per cent in Manipur but increased from 6.41 per cent to 60.71 per cent in Mizoram and 17.08 per cent to 43.09 per cent in Meghalaya.

2) Oilseeds covers 6-8 per cent of gross cropped area except in Manipur (2.42 per cent), Meghalaya (3.76 per cent) and Tripura (3.26 per cent).

3) Area under wheat increased tremendously since later part of the seventies in Assam, on account of spillover benefit of green revolution but started declining after 1985-86

4) Pulse area is stagnant in Assam around 1.10 lakh ha and subjected to constraints of soil moisture stress in the sowing season, poor management, problems of disease and pests and lower yield. However, the cultivation of pulses is spreading in Arunachal Pradesh, Mizoram, Nagaland, and Tripura since the eighties.

5) Jute and sugarcane are mainly grown in Assam and in minor proportion in Meghalaya and Tripura. Jute area is declining in all these states due to problems of retting, processing and marketing. Cotton is another crop grown in the region particularly in Meghalaya. Potato is gaining popularity in the cropping patterns of all the N.E. states except Mizoram.

6) Horticultural crops, particularly banana, arecanut, coconut, papaya, tapioca, sweet potato, orange, mango, guava, litchi, jack fruit and a number of vegetables are grown in all states while apple is grown in Arunachal Pradesh and Nagaland. Spices of various types like onion, chillies, ginger, and turmeric are found throughout the region.

Growth of Production and Productivity

During 1970-1995, the annual average growth of production and productivity were 2.95 per cent and 1.68 per cent respectively in the N.E. states against the corresponding all-India rate of 3.6 per cent and 2.68 per cent. Total food grain production increased from 27.19 lakh tonnes to 47.24 lakh tonnes while yield increased from 1,002 kg/ha to 1,424 kg/ha during the period. Yield of rice is the highest in Manipur (2,552 kg /ha) followed by Tripura (1840 kg/ha). Adoption of improved cultivation practices like use of HYV and plant nutrients have contributed to yield improvement in these states. But in other states like Arunachal Pradesh, Mizoram and Nagaland, the yield of paddy is 1,062 kg/ha, 958 kg/ha and 868 kg/ha respectively. In Assam, oilseeds have shown positive growth with improvement in yield from 417 kg/ha to 549 kg/ha. Wheat showed tremendous growth particularly in Assam during 1970-71 to 1980-81 primarily due to the influence of the national strategies of wheat development under green revolution. But its momentum got dampened after mid-eighties and showed negative growth since 1990-91. Maize showed positive growth in the hill districts of Arunachal Pradesh, Meghalaya, Nagaland and Tripura. Small millets are showing rising trend in yield in Arunachal Pradesh and Assam, while it is declining in Meghalaya and Nagaland. The scenario for the pulses is not encouraging and its area remains stagnant. Poor crop management mainly in rainfed situation is one of the reasons for slow growth. Severe scarcity of agricultural labour affected jute and sugarcane thus showing negative growth despite satisfactory yield performance (say 1,721 kg/ha in Assam, 1,629 kg/ha in Tripura). Poor marketing infrastructure and dominance of middlemen, problems of processing of sugarcane, closure of sugar mills in Assam, affected farm income. Potato is an important cash crop in the hill districts. Potato shows positive growth throughout the period and the yield has improved from 4,653 kg/ha in 1970-71 to 7,948 kg/ha in 1995-96.

Horticultural Crops

The plain and valley land of Assam, Tripura, Manipur are suitable for most of the tropical and subtropical fruit crops like banana, pineapple, citrus, coconut, mango, jackfruit, papaya, litchi, guava etc. However, banana, pineapple, citrus, papaya, peas, plum, peach apple, etc are also widely grown in hills of Meghalaya, Mizoram, Manipur, Nagaland and Arunachal Pradesh. Arecanut, betelvine and several spice crops are grown throughout the region. Enormous variations of crops as well as practice of growing vegetables both in *kharif* and *rabi* are seen in the region. As per estimates of North Eastern Council, the region produces 23.44 lakh tonnes of fruits in 4.87 lakh ha area and 1.22 lakh tonnes of spices like turmeric, ginger, onion and chillies. In addition, about 25.36 lakh tonnes of vegetables are grown in about 2.0 lakh ha area. Among the fruit crops, banana is the most

popular crop and grown in all N.E. states producing 714.3 thousand tonnes in 60.24 thousand ha area. In Arunachal Pradesh, wild and seedy banana are found in forest areas. The cultivation of pineapple is concentrated in Assam, Meghalaya and Manipur covering 37.87 thousand ha producing a total of 307.68 thousand tonnes.

Among the citrus crops, mandarin orange and lemon are of commercial types grown in all N.E. states, which cover an area of 71.88 thousand ha. But the area under mandarin orange is declining due to the problem of dieback and poor management. Regular and commercial cultivation of temperate fruits like plum, peach and peas are found in the higher elevation of Arunachal Pradesh, Mizoram, Manipur, Nagaland and Assam (N.C. Hills). Arunachal Pradesh has 5.1 thousand ha under apple cultivation mainly in the Kameng District where rainfall is around 900 mm. Other promising temperate fruits like walnut, almond, cashewnut is grown in Arunachal Pradesh and Tripura. Coconut and arecanut are the crops with high commercial value and these are grown mainly in Assam, Meghalaya and Tripura in an area of 1.10 lakh ha. There is enough scope for increasing farm returns through value-addition by use of efficient post-harvest management practices. The horticultural crops generate substantial marketable surplus for which adequate processing facility is necessary for value-addition and commercial trading. There is also need for storage, processing and marketing facilities, which are largely absent in the whole region.

Constraints to Agricultural Development

Uneconomic and fragmented holdings: The marginalisation of farmers is a dominant factor adversely affecting household income. Over 60.27 per cent of the operational holdings are below 1.0 ha and 22.18 per cent of the holdings are in the farm size group 1-2 ha. Except Nagaland, in other N.E.states, the size of operational holding is very small. Such small holdings are uneconomic and results in under-investment in agriculture leading to low input use and low production.

Low adoption of improved technology: The adoption of high-yielding varieties of rice varies between 42 to 50 per cent in Meghalaya, Manipur and Assam and 23 to 34 per cent in Arunachal Pradesh, Nagaland and Mizoram. Highest adoption of HYV is observed in Tripura at 96.77 per cent. Although more than 85 per cent area of wheat is under HYV but covers only around 2 per cent of gross cropped area. The main causes of slow growth of HYV area are the non-availability of suitable seeds, predominance of traditional seeds in hill areas under *Jhum* cultivation, short supply of recommended seeds and defective distribution system.

Fertilizer consumption is extremely low and variable. Fertilizer use is the lowest at 2.29 kg/ha in Arunachal Pradesh and the highest in Manipur at 72.46 kg/ha. In Meghalaya, the fertilizer use is declining from 15.55 kg per ha in 1986-87 to 13.39 kg in 1997-98, the same is stagnant at around 3 kg in Nagaland. There are number of factors limiting the expansion of fertilizer use such as defective distribution system, poor transport and communication system and inadequate institutional credit.

Irrigation is another crucial constraint to agricultural production, which, at present covers less than 10 per cent of the gross cropped area. Ineffective O&M system is responsible for poor performance. It is ironical that the region with annual average rainfall as high as 3,400 mm, also faces water problems. It implies that development of water resource is extremely poor and the state support is weak. For example, on account of inefficient management system, about 109 state-owned watershed projects in Assam are currently unused, making the investment infractuous. Under the circumstance, people's initiative is required in proper rainwater harvesting and redistribution in the dry season crops. The introduction of state sponsored scheme of installing 1.0 lakh shallow tubewells is a wellcome deviation, which has received encouraging response from farmers in the cultivation of early *Ahu* and *Boro* rice. This also indicates the need for assured water supply.

Flood problem : Flood is a major natural disaster regularly causing inundation and damage of standing crops, delay transplanting of main rice crop (Sali), which results in low yield. About 3.0 lakh ha of cropped area are annually affected by flood in Assam. The large-scale soil erosion also takes place. About 0.49 lakh ha were eroded in 1997. The worst soil erosion affected districts are North Lakhimpur (to the extent of 0.31 lakh ha of soil erosion) and Darrang (9,877 ha).

Technological Constraints

1) Lack of suitable high-yielding rice varieties for diverse upland situations, flood affected areas, moisture stress conditions, and hill areas

2) Alternative crops for escaping pre-monsoon showers to avoid the problem of pre-harvest sprouting of crop in flood, free period

3) Develop improved crop management practices for shifting cultivation

4) Improvement and standardization of production techniques of fruits and vegetable crops

5) Use of improved post harvest management including pest and disease management and processing techniques for the major cash crops and horticultural crops

6) Land and water management technique specifically for acid soils

7) Economic packages for integrated farming systems combining crop cultivation with livestock, fishery, etc.

8) Integrated livestock management system for increased livestock products as well as draught power. The facilities of storage, processing and marketing are particularly deficient for perishable commodities. The access to institutional credit facility to the farmers must be improved substantially.

Rural Transport and Communication Network

The transport and communication facilities also need marked improvement in the difficult terrains of hills, dense forest, rivers, etc. At present, availability of road per 100 sq. km is low at 45 km against 62.8 km at all-India average. Baring Assam, the Railway network is practically non-existent in the region. Most of the rural areas remain inaccessible during rainy season for non-availability of all-weather roads.

Attitude Towards Agriculture

Agriculture is the most preferred activity of a large section of the population in the region, yet the method of cultivation is indigenous. In view of the rapid technology turn over, appropriate strategy for HRD is required to maximize farm income through adoption of cutting-edge modern technology. The farmers usually stick to old practices and the younger generation distracts, which makes agriculture an occupation of elderly people living in rural areas. To attract enterprising youths to take up farming as profitable occupation and to reverse the out-migration, innovative strategy such as commercialization of agriculture and adoption of improved methods must be promoted.

Socio-economic Constraints

The N.E. India has diverse ethnic groups and social systems bound with customs and traditions. These factors clearly differentiate the type of economic activities and the economic status of the population, which inhibit the adoption of modern methods. Carefully prioritized strategies for agricultural development of the region may become instrumental to break the deadlock.

Prioritization and Policy Perspectives

1) Development of irrigation facilities and promotion of water-harvesting methods for assured water supply particularly in the rabi season.

There are high prospects of increasing crop productivity under irrigation

2) Creation of “single window” input delivery system in the rural areas to ensure timely supply

3) Surveillance of major pests and diseases and adoption of timely control measures

4) User-friendly information system through improved method such as on-farm trials, demonstration, training, farmer-participatory interaction programme along with programmes for updating knowledge and skill of field level officers

5) To identify need-based programmes for overcoming technology gaps through extensive field surveys under diverse agro ecological and socio-economic situations

6) Programmes to promote the development of cash crops like jute, sugarcane, maize, horticultural crops, etc.

7) Creating storage facilities particularly cold storage for perishable commodities

8) Introduction of value-addition to agricultural produce through research and development activities

9) Agricultural development programmes must take care of cropping pattern in the pre-and post-flood situations particularly in flood-affected areas including development of allied agricultural activities

10) Improved crop cultivation practices for Jhumming in hill areas

11) Financial support for creation of agricultural infrastructure such as strengthening irrigation facilities, farm machineries, processing and storage facilities, rural roads and communication

12) Marketing infrastructure to be created at the primary markets in rural areas and regulated markets in district level. The dominance of traders and middlemen to be reduced so that farmers is a powerful force for distress sale

Conclusion

The rich resource base in the region such as mega bio-diversity, fertile soil, varied agro-ecological situations of plains as well as valleys, hills, *tilla* land, immense water resources, human resources of ethnic diversity and cultural groups, could be potential sources of agricultural as well as economic development of the N.E. India. However, due to lack of appropriate strategies for development of natural resources, absence of coordination in programme implementation, weak geographical links and poor

infrastructure facilities, the region is handicapped in catching up with the agricultural developmental pathways in tune with the national ethos. Slow agricultural development widens the disparities across the states. In this circumstance, agricultural sector needs prioritization of development perspectives for enhancing the adoption of recommended technologies through extension programmes, input supply, support of financial institutions and marketing functionaries. More crucially, the research and development programmes must address the problem of generation of need-based location-specific technologies for the specific agro-ecological situations[1]

[1] Detailed background tables are available with the authors

4 STATUS, CONSTRAINTS AND STRATEGIES FOR AGRICULTURAL DEVELOPMENT IN ASSAM

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Introduction

Agriculture plays a vital role in the economy of Assam contributing about 35 per cent to the state domestic product in 1996-97 at constant price (1980-81). The Government has, therefore, assigned very high priority to agriculture. This was reflected through a quantum jump in rice production to 39 lakh tonnes in 1999-2000 from the level of 33.82 lakh tonnes and 32.54 lakh tonnes in 1997-98 and 1998-99, respectively. This was achieved through creation of assured shallow tubewell (STW) irrigation with the assistance of World Bank (ARIASP) and NABARD (Special Kishan Yojana) scheme. Although regular flood, drought, heavy population pressure on land and infrastructural weakness are the impediments to growth, yet the farmers have started to increase production through technological innovations and appropriate Government policies. During the next quarter century, the tempo of raising productivity and production must be accelerated along with integration of our economy with outside economies necessitated in the aftermath of liberalization.

Present Status

Distribution and ownership concentration of land (1990-91): The Economic Survey, Assam 1998-99 painted a grim picture of land distribution among different size classes of operational holding. The marginal holding with less than 1 ha of land accounted for 60.3 per cent of total holding and 19.3 per cent of total operated area in the state. The share of small holding with size class between 1-2 ha is 22.2 per cent of total holding and 24.5 per cent of the total operated area. On the other hand, the large holding (20 ha and above) constituted only 0.09 per cent of the number of operational holding with 11.3 per cent of the total operated area of the state. An important feature revealed by the report is that the average size of operated holding in the state recorded a declining trend over the successive census which was 1.37 ha in 1976-77 and declined to 1.27 ha In 1990-91. However,

large-scale organization of Field Management Committees (FMCs) among farmers of the state to protect them from economic vulnerability has to an extent contributed towards instilling self-confidence and enabling them to participate in agricultural development process. The process of strengthening and re-organization of FMCs have recently been initiated for making them more effective in fulfilling the objectives.

The provisional estimates of land utilization statistics of the state indicate that Assam has an estimated 39.94 lakh ha of gross cropped area of which net area sown is about 27.51 lakh ha. This constitutes about 35 per cent of the total geographical area of the state. The cropping intensity of the state stands at 145 per cent. With the improvement of irrigation infrastructure of the state vis-à-vis installation of a large number of shallow tube wells, the cropping intensity has increased to a great extent from the year 1999-2000 onwards. However, the exact increase in total cropped area is under process of estimation.

Horticulture

The total area under major horticultural crops in the state is 5.43 lakh ha, out of which fruit crops occupy an area of 1.05 lakh ha, spices 0.79 lakh ha, tuber crops 0.86 lakh ha, nut crops 0.95 lakh ha, and vegetables occupy 1.79 lakh ha. The existing area and production of major horticultural crops in Assam and the predominant district (1998-99) are given in table 1.

Table 1: Area, production and productivity of fruits and vegetables

	Name of the crop	Area in ha	Production in tonnes	Av. yield in kg	District where predominantly grown
Fruits	Banana	41885	581884	13892	Barpeta, Kamrup, Nagaon, Cachar, Nalbari, Golpara, Jorhat, Golaghat, Sonitpur, Sibsatgar, Tinsukia
	Pineapple	13582	208993	15387	Kamrup, Nagaon, Karbi Anglong, N.C. Hills, Cachar
	Orange	5720	67659	11820	Tinsukia, Karbi Anglong, North Cachar, Kamrup, Gopalpara, Darrang, Dibrugarh
	Papaya	7347	108479	14765	Nagaon, Darrang, Kamrup, Karbi Anglong, N. Cachar, Nalbari, Barpeta, Sonitpur, Dhubri
	Assam Lemon	8705	47233	5426	All districts of Assam
	Guava	3681	47611	12934	All districts of Assam

	Litchi	4028	16815	4175	All districts of Assam-mainly Kamrup, Sonitpur and Bongaigaon
	Jack-fruit	17298	153645	8882	All districts of Assam
	Mango	2570	17173	682	All districts of Assam
Total		104816	1249492	1192	
Spices	Chilli	14724	9619	658	Dhubri, Barpeta, Darrang, Nagaon
	Turmeric	10729	7416	691	Kamrup, Darrang, Nagaon, Barpeta, Sonitpur, Nalbari, Bongaigaon
	Onion	8083			
	Ginger	16244	113771	7280	N.C. Hills, Cachar, Karbi Anglong, Kamrup, Barpeta, Sonitpur, Nagaon
	Coriander	19346	14354	742	Dhubri, Kamrup, Barpeta, Sonitpur, Nagaon, Morigaon, Darrang, Goalpara
	Garlic	7430	21694	2920	Dhubri, Kamrup, Barpeta, Nagaon, Lakhimpur, Goalpara, Darrang
	Black Pepper	2077	2810	1353	Jorhat, Sibsagar, Kamrup, Nagaon, Golaghat, Dibrugarh, Cachar, Barpeta
Total		78633	188076	2392	
Nut crops	Coconut	20166	149866 (in '000 nos)	69 nos (per tree)	Nagaon, Nalbari, Kamrup, Morigaon
	Arecanut	74457	55355 (Dry nuts)	131 nos (per tree)	All Districts of Assam
Tubers.	Potato	76958	611077	9740	Barpeta, Darrang, Kamrup, Sonitpur, Nagaon, Dhubri, Nalbari
	Sweet Potato	943	32437	3438	Dhubri, Kamrup
	Tapioca	2798	13261	4739	Kokrajhar, Nalbari, Darrang, Karbi Anglong, Goalpara
Total		86391	656775	7602	
Vegetables	*Kharif*	56857	537786	9411	All districts of Assam
	Rabi	121622	1845435	15230	All districts of Assam
Total		**178479**	**2383221**	**13205**	

Irrigation: There were hardly 0.61 lakh shallow tubewells installed in Assam till 1995-96. In the subsequent four years, there was a quantum jump both in terms of number of tubewells installed and irrigated area. Under the ARIASP programme (World Bank) and SKY, NABARD, an additional 1.47 lakh shallow tubewells were installed by January 2001 (0.47 lakh under ARIASP and 1.0 lakh under SKY). This will provide assured irrigation to 2.95 lakh ha area. By adding the irrigated area under the shallow tubewells and other sources, the total assured irrigation will increase to 5.27 lakh ha. Presently, 20.7 per cent of the net cropped area and 35.68 per cent of the gross cropped area is covered by irrigation.

Fertilizer consumption: Fertilizer consumption (NPK) in Assam has increased from 2.4 kg/ha in 1971-72 to 29.3 kg/ha in1999-2000. It is projected that in the year 2000-2001, consumption of NPK would be 50 kg/ha and 70 kg/ha in 2005-2006. Rest of the unmet requirements would be met by integrated nutrient management (INM) method in conjunction with bio fertilizer, green manure and organic manure.

Seed: Non-availability of quality seed is a perennial problem particularly of paddy and mustard. In order to address the problem of seed, the Government of Assam leased out about 40 seed farms to private entrepreneurs with an idea of producing required certified seeds in the state. The seed farms, which are already leased out, have started producing certified seeds of local demand. Thus, the private participation in seed production and marketing through seed merchants/traders and entrepreneurs should be encouraged for attaining self-sufficiency in the State.

Agricultural Mechanization

The growth of mechanization in Assam is slow. However, after introduction of large-scale shallow tube-well irrigation, requirement of farm power has gone up. The following are the estimates of power available for raising agricultural crops in Assam.

Category of power	Amount (HP per ha)
Human power	0.090
Animal power	0.204
Mechanical power	0.008
Total available power	0.302

The current power availability to the farmers of the state is barely 0.3 HP per ha, which has become one of the constraints towards increasing area under double or multiple cropping. In order to supplement the inadequate

draught power, farm mechanization to fulfill the need for multiple cropping is a challenging task.

Constraints

Agricultural development in the state confronts a number of constraints, which are illustrated below.

Low availability of farm power: The current power availability to the farmers in the state is barely 0.3 H.P. per ha as against 1 H.P in the neighborhood. Low availability of farm power has become one of the constraints to double or multiple cropping. This has been acutely felt after expansion of area under irrigation through large-scale installation of shallow tube-wells.

Inadequate availability of seeds and planting materials: The NE states are not self-sufficient in production of required seeds except for paddy, mustard. Hence, the region is almost dependent on outside supply to meet its requirement of seeds. The infrastructural inadequacy and humid subtropical climate of the state make the process of seed production a complex procedure. Horticulture development has suffered from inadequacy of quality planting materials. This is due to lack of trained personnel and standard mother plants.

Poor post-harvest technology and facility: After the expansion of micro-irrigation through installation of shallow tubewells, the area under summer rice has increased considerably. The state government has launched an ambitious programme to increase the area of summer paddy up to 10.0 lakh ha. The harvesting period of summer rice coincides with high rainfall making the process of drying and threshing difficult. The post-harvest handling of summer rice viz. threshing, drying and milling will continue to remain a problem till some innovative measures are introduced. The processing of pulses and non-traditional oilseeds like sunflower and groundnut is also a problem in the state. In horticulture sector, there is huge post-harvest loss due to lack of technology, product information and inadequate processing infrastructure.

Poor marketing infrastructure: Marketing has been a major problem. The price spread between the producer and consumer is too wide due to absence of organized market. The storage facility including the proper storage technology has been a problematic area. The cold chain system is virtually non-existent in the state. Absence of agro-processing industry make the farmers vulnerable to market volatility. Collection and dissemination of market information system is hardly adequate. Transportation of commodities from rural area is far from satisfactory due to poor rural connectivity.

Chronic flood: Approximately 3 lakh ha of crop area is subject to annual flood. High rainfall also makes the management of the crop difficult. These factors act as deterrent to the investment on farming.

Recommended Strategies

The strategies for agricultural development will be directed towards generating enough employment and achieving the targets fixed for agricultural production by the year 2005-06 (Table 2).

Table 2: Crops and targets for 2005-2006

Crops	Targets
Rice	47.54 Lakh tonnes
Wheat	6.34 Lakh tonnes
Pulses	1.40 Lakh tonnes
Oilseed	4.23 Lakh tonnes
Fruits	16.09 Lakh tonnes
Vegetables	39.71 Lakh tonnes
Spices	2.61 Lakh tonnes

In order to achieve the above targets, the following strategies are proposed (Table 3).

Table 3: Strategies for agricultural development

Strategies	Activities
Conservation of natural resources	1 Protection of forest and soil 2 Conservation of rainwater 3 Development of natural ecosystem like swamp and beel
Poverty alleviation strategy	1 Sustainable method of agricultural production 2 Participation and Involvement of women 3 Land report or access to input to marginal or small farmers
Self-sufficiency in food	1 Increase productivity of rice 2 Pulse crop promotion 3 Oilseed development programme 4 Horticultural crops
Hill agriculture	Integrated approach to problem-ridden hill agriculture

Employment generation	1 Service sector employment 2 Farm sector employment
Peoples' participation	Improvisation of FMC and SHG
Hi-tech agriculture	1 Mechanization 2 Bio-technology and GMO 3 Phytosanitation and food sanitation 4 Information technology (newer technology and market intelligence)
Agricultural trade	Effective marketing and commerce
Infrastructure	1 Irrigation 2 Road transport 3 Storage and post-harvest management 4 Agricultural credit and banking 5 Agro-processing facilities
Human resource development	1 Farmers' training programme

[1]

[1] Detailed tables and relevant data are available with the author (s)

5 STRATEGIES FOR DEVELOPMENT OF ANIMAL HUSBANDRY IN ASSAM

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Animal husbandry is a sub-sector of agricultural economy and plays a significant role in rural economy by providing gainful employment, particularly to the small and marginal farmers, women and agricultural labourers. Livestock production in Assam is pre-dominantly the endeavour of small holders. Almost 90 per cent of the rural households keep livestock of one species or the other. Livestock farming is practised traditionally mostly for agricultural operations. Milk production is secondary to agricultural operations. There are hardly any commercial livestock farms in the rural areas although in the periphery of cities and towns a few commercial dairy farms exist.

The paper aims at examining the various issues related to livestock production vis-à-vis the development of animal husbandry sector in Assam, and to identify the constraints and strategies to be adopted for better growth and development of livestock production and productivity in Assam.

Livestock Resources

Livestock in the state is highly livelihood-oriented and is generally owned by small and marginal farmers and landless agricultural labourers. The livestock is basically a component of production system, contributing to sustainable agricultural systems. The livestock population in the state is very large in numbers but its productivity is very low compared to other parts of the country.

The composition of livestock population of Assam consists of 63.4 per cent cattle followed by goat (21 per cent). Buffaloes accounts for 5.8 per cent while the share of pig is 8.62 per cent and of sheep is the lowest, i.e. 0.66 per cent. Assam does not have any economically important breeds of livestock except the indigenous bullock (2.06 million) on which most of the agricultural operations depend. The indigenous cows are of poor reproductive efficiency. All the breeds of livestock are native to Assam. Efforts are necessary to upgrade the indigenous cattle, goat and pigs through infusion of exotic/Indian breeds of cattle, goat and pigs. There are

3.69 lakh of crossbred cattle (Jersey x local) in Assam, which is a negligible proportion of the total cattle population. The buffaloes in Assam are mostly of swamp type. About 1.8 lakh male buffaloes are used for cultivation of paddy, drawing carts and logs of timber. No river-type buffaloes are found in rural Assam. Swamp buffaloes are poor in milk production and are good source of buffalo meat production but, this has not yet been exploited commercially. Goat is very popular all over the state. It adapts quickly to harsh environment and has high reproductive efficiency, fair milk yield and excellent meat quality.

Pigs are reared predominantly by the tribals. Pork is getting popularity day by day. The 'Desi' pigs are poor in productive and reproductive efficiency. There is tremendous scope of improvement of this 'Desi' pigs by crossing with exotic pigs like Hampshire, Berkshire etc. in the region.

The detailed pattern of growth of livestock population is provided in Bhowmick and Kalita in this volume. The man-animal ratio is very high in Assam as compared to the national figure. In 1987, per 100 persons there were 50.2 cattle, 3.9 buffalo, 0.50 sheep, 10.2 goats and 4.2 pigs in Assam and the same in other states in N.E. India is 46.4, 3.7, 0.6 and 6.9 respectively while the respective figures at all-India level are 27.8, 10.17, 13.1 and 1.15. The 1999 livestock census shows that there are 35.8 cattle, 3.24 buffaloes, 0.37 sheep, 11.95 goat and 4.83 pigs per 100 persons. The reduction in number of cattle may be due to overwhelming increase in human population. The man and animal competition also affected man-animal-land ratio. There are 4.53 livestock per ha of net-sown area in 1999 compared to 5.2 in 1987 (Jain and Dhaka, 1993). It appears that there is higher concentration of livestock in Assam as compared to national level.

Livestock Rearing System

By and large, cattle, buffalo, sheep and goat in Assam are reared under traditional system (extensive) of management, i.e. the animals are let loose throughout the day and in the evening they are tied in animal shed made of locally available materials. In contrast to rural areas, around the cities and towns intensive management system is generally practised particularly for the crossbred cattle meant for milk production. The cows are housed throughout the day and night. The animals are stall-fed with cut grasses and tree leaves along with feeding roughage and concentrates. Community grazing system is rarely seen even in rural areas. The disappearance of at large number of village grazing reserve (VGR) and professional grazing reserve (PGR) due to increasing human population pressure adversely affected the livestock sector.

Feed Resources

The production of livestock, particularly that of ruminants, depends on the availability of quality feeds and fodder. Good quality grass/fodder helps in increased production on milk and meat at a cheaper rate. The cultivation of quality grass/fodder is rare and the quantity is inadequate. Because, the smaller land holdings are devoted to cultivation of food crops on first priority and the cultivation of fodder gets lower priority.

Animal Productivity

Production of milk, meat, eggs are minimal in Assam. The availability of milk is 89 grams and of meat 20 grams per day and only 22 eggs per person per year in the year 1999-2000. The pattern of production during the period 1985-86 to 1999-2000, shows an increase in production of 35 per cent, 40 per cent and 45 per cent of milk, eggs and meat respectively. However, the demand for these products is much larger than the production.

The basic reason for such a low production is the absence of good breeds of cattle, buffalo, goat, pigs and poultry coupled with shortage of concentrate feed and green fodder.

Constraints

The major constraints hindering the development of animal husbandry in Assam are listed below:

1) Lack of stated policy on animal breeding and other strategies on livestock development in Assam

2) The effective technology intervention on Artificial Insemination has not been fully put into gear. Except cows, other species of animals have not been covered under A.I programme

3) Absence of quality breeds of animals, all the animals are nondescript types resulting in poor animal productivity

4) Acute shortage of feed concentrate and green fodder is the root cause of the poor performance as the genetic potentiality of an animal cannot be exploited fully in the absence of proper nutrition

5) High animal density is a management deterrent

6) Small land holding size limiting cultivation of fodder. The entire land is put under crop production for human consumption

7) Lack of perception of farmers' to real need and poor research focus and planning. Poor linkage between the concerned government

department and the agricultural university resulting in poor feedback from the field of veterinary to the university. This has created a void in the research focus and planning

8) In adequate monitoring of field works, feedback on failure, rate of adoption of the scientific knowhow imported through various trainings

9) There is no compound feed manufacturer in the whole of the N.E. India. As a result the utilization of non-conventional feed resources could not be maximized

10) Presence of fragmented, unorganized market for all livestock products, which involves chains of middlemen who reap the actual benefit depriving the real producers of their rightful share

11) Poor perception of the farmers towards livestock production as a viable alternative

12) Recurrence of flood causes high incidence of parasitic disease mostly in ruminants

13) Inadequate surveillance and monitoring of infectious and contagions diseases

Strategies

1) There is a need to evolve a comprehensive livestock development policy in the state involving the Agricultural University, Department of Agriculture, Department of Industry and the Department of Animal Husbandry and Veterinary

2) Genetic improvement of the indigenous non-descript animals through crossbreeding with superior germplasm and the subsequent inter-se-mating with FIS. Selective breeding of some indigenous breeds of livestock could be an easier option

3) Upgrading the indigenous buffaloes through improved breeding of animals of Indian origin

4) Availability of quality breeding animals/birds to the livestock farmers is to be ensured.

5) Utilization of straws/crop of cereals and food crops with suitable treatment

6) Introduction of urea molasses blocks in rural areas

7) The Government should encourage establishment of compound feed manufactures unit to exploiting of non-conventional feed resources, land to produce economic ration

8) Suitable plan and strategy for cultivation of green fodder in the fallow land

9) Facility for A.I and pregnancy diagnosis at farmers door needs to be located

10) Activation of A.H. extension service to make farmers familiar with the scientific practices

11) Exploitation of modern tools for enhancing productive and reproductive performances in cattle through ETT may be taken up in the cattle breeding farm, Barpeta where pure bred jersey cattle are maintained

12) Timely prophylactic measures and emergency of services for treatment of livestock

13) Establishment of organized networks of market so that the livestock farmers get due share for their products

14) Intensive epidemiological studies of the livestock diseases particularly the infectious diseases should be under taken to plan programme for control and eradication

Conclusion

The key to better livestock production is the availability of quality animals, quality feed and fodder and effective disease control measures. There should be a comprehensive policy approach to deal with the above key factors. The fallow land needs to be exploited for cultivation of green fodder and the utilization of non-conventional feed resource may augment the feed supply situation. The coordination and collaboration approach in programe implementation by the Assam Agricultural University, State Animal Husbandry and Veterinary Department and State Agricultural Department should be a priority activity.

Though modern biotechnology tools for improved livestock production are available in India, applicability of biotechnology tools in rural areas are yet to be assessed and standardized. Cross breeding of indigenous animals with superior germplasm, through A.I. in extensive manner will surely improve the livestock scenario of Assam. Access to information and motivation of farmers towards A.I of cattle and other species are the need of the hour.

6 PERFORMANCE OF LIVESTOCK AND FISHERY: CONSTRAINTS FOR AGRICULTURAL DEVELOPMENT AND PRIORITIZATION OF STRATEGIES

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Livestock is considered as one of the important homestead activities in the farm households in almost all the N. E. states while fishery enhances family income. In the rural household economy, livestock is considered as an inseparable component in the whole farm business, which is the source of milk, meat, egg, manure, draught and transportation. It provides nutritional security to farm family and stabilizes farm income too. There are certain breeds of animals, which are unique in the N.E. India. Nevertheless, large percentage of the animals in this part of the country is of non-descript type, poorly reared and less productive. Whatever development has taken place in terms of production and productivity of livestock and fisheries in this region could be attributed to mainly the efforts of the farmer/rearer in general and natural growth of animals rather than technological intervention.

In this paper an attempt is made

1) To study the present status and performance of different livestock and fishery in different N.E. states, and

2) To identify the constraints and drawing appropriate strategies for development of these sectors

Data and Methodology

The study is based mainly on secondary data from various published sources. The tabular analysis and compound growth rates were computed to show the status of livestock population and production of different N.E. states (1982-92). In the case of livestock population annual compound growth rates of inter-census period was computed using the following formula:

$$P_t / P_o = (1 + r)^t / 100$$

Where, P_t is population in the t^{th} period
P_o is population in the base period
r is the compound growth rate

In certain cases data were not available or partially available and in some cases the data had to be obtained through linear interpolation or extrapolation as and when necessary.

Results and Discussion

Livestock population dynamics: The livestock population in all the N.E. states has recorded moderate to high growth. Assam being the largest state in the region, exhibits the highest number of livestock in respect of almost all the animals. In the case of cattle population, the growth per annum in N.E. India is 3.87 per cent ranging from 1.87 per cent in Mizoram to 8.20 per cent in Nagaland, while Manipur experienced a negative growth (-0.38 per cent). The swamp buffalo of Assam and Manipur are important animal resource and source of milk and draught power. The buffalo population has recorded a growth rate of 4.30 per cent in this region though the state of Arunachal Pradesh (-8.38 per cent), Manipur (-1.89 per cent) and Sikkim (-2.93 per cent) experienced a negative growth of number of buffalos during the inter-census period; 1982-92. But, Assam, Mizoram and Nagaland, showed substantially higher growth of 5.56 per cent, 5.76 per cent and 13.52 per cent, respectively. Goat and sheep are the important sources of meat especially in the region. The annual growth rate of goat population is 20.11 per cent in Arunachal Pradesh in the inter-census period (1982-92) followed by 9.31 per cent in Nagaland and 7.16 per cent in Assam. In Manipur and Mizoram, the population of goat decreased by 1.00 and 2.84 per cent respectively. Tribal and schedule caste people of the region generally rear large number of wild pigs. Pig and beef are major sources of animal protein for the tribal people in most of the hilly states. The growth in the number of pigs per annum was only 1.31 per cent in the N.E. India ranging from 0.40 per cent in Manipur to 4.22 per cent in Sikkim while the same declined by 1.45 per cent in Tripura. In the case of horses and ponies except Meghalaya, other states showed marginally higher growth. Meghalaya exhibited a negative growth of 12.94 per cent in the number of horses and ponies.

Yak is a unique animal resource of Arunachal Pradesh and Sikkim. The growth of Yak population in Sikkim is to the tune of 3.63 per cent. Yak is also an important supplier of milk, meat, hair, hide and wool. It is also used for draught purposes and is the main mode of transport system in the high hills. Moreover, crossing of local cows with yak is a common practice. Females born with this process is fertile but the male used to be sterile and are useful only for draught and meat[1].

[1] Arun Varma, 1992, Livestock Farming in the Northeastern Region, Agriculture of the Northeastern Region with special reference to hill agriculture, Bee Cee Prakashan, Guwahati.

There has been a phenomenal increase in the number of poultry in all the NE states, but the growth rates vary from 1.31 per cent in Manipur to 9.18 per cent in Tripura.

Livestock Production

Meat production: In the hill areas of Northeastern states, meat is an important and commonly used source of animal protein. The tribal population prefers beef and pork while mutton is highly preferred in Assam, Manipur and Tripura. Total meat production in the region is estimated at over 73 thousand tonnes. The growth in meat production (1993-94 to 1997-98) is estimated at 1.8 per cent in the region with Nagaland having the highest growth (17.16 per cent) followed by Manipur (3.77 per cent) and Arunachal Pradesh (2.61 per cent).

Milk production: The NE India is deficient in milk production. Against the national average of 199 gms per capita per day availability, the average availability in this region stood at 84 gms only. The growth in production of milk during the period 1985-97 was 4.06 per cent, which has decreased to 2.31 and 0.46 per cent in the later period i.e. 1985-92 and 1992-97 respectively. Thus the growth is not sustained. The production of milk is the highest in Assam though the growth rate (8.91 per cent per annum) is increasing in Tripura. This could be attributed mainly to well planned improvement in quality of milch cattle in Tripura through artificial insemination programme.

Egg production: The region produces approximately 876 million eggs per annum showing an annual compound growth rate of 2.83 per cent. Thus, annual per capita availability of egg is worked out at 25 eggs against the normative requirement of one egg a day. Therefore, there is a lot of scope for developing poultry and duckery in this region. Production of eggs in the N.E. India recorded a steady increase from 533 million in 1985-86 to 876 million eggs in 1997-98. Assam alone produces more than half of the total eggs. Tripura and Meghalaya respectively contributed 12 and 10 per cent towards total production of the region. Bulk of these is poultry egg. Interestingly, the growth of production of egg during the period 1985-92 was 5.09 per cent, which declined to 1.72 per cent during 1992-97. There has been a decline in egg production in the state (-0.64 per cent) of Assam and a marked decline of 3.86 per cent in Manipur.

Veterinary services: To facilitate development of livestock sector in the Northeast, efforts have been made to upgrade the local non-descript cattle through the programme of artificial insemination. The A.I. programme was taken up during the 1980's in most of the N.E.states. Nevertheless, during the 1990's the tempo has slowed down except in Mizoram and

Arunachal Pradesh. But, the number of mobile dispensaries continues to increase from 25 thousand in 1988 to 2095 in 1997 and A.I. centers from 29 to 1698.

Composition of cattle by farm operational holding: Usually, the cattle are used for farm work and in few cases for breeding plus other work. Cross-bred cows are used mostly as milch animals. The number of cattle per 100 households showed concentration of animals between operational holding class 0.51 to 1.00 ha and 4.01 to 10.00 ha in Assam, Manipur, Tripura and Sikkim while in other states concentration is more in the operational holding class 0.21 to 0.50 ha and 2.01 to 4.00 ha. The NSS (56 round) data, however, shows the number of non-bovine large heads per hundred households is approximately 8 in Nagaland to 126 in Sikkim. In the case of pigs, Arunachal Pradesh, Nagaland and Meghalaya showed 1 pig per family. The number of poultry per farm varied between 5 in Tripura to 18 in Arunachal Pradesh. Arunachal Pradesh has the highest number of pigs and poultry per household as compared to other states. Concentration of non-bovine large heads was more in the larger operational holding.

Status of fishery in the northeastern India: Despite high potential for production of fish, the region is deficient in fish production and presently fish is imported from other states like Andhra Pradesh, Bihar, Uttar Pradesh, and West Bengal. The hypsographic profile and the river systems of the region reveal rich repository of aquatic resources that have great potential for development. The fisheries resource of the region comprises three important river basins viz., Brahmaputra, Barak and their tributaries. There is potentiality of producing both the cold and warm water fisheries in this region. The water resource of this region can be broadly classified into two categories viz., riverine comprising rivers and streams and inland reservoirs, lakes and beels, tanks and ponds. The total riverine including fisheries resources of over 20 thousand kilometers along with approximately 44 thousand ha of inland fisheries resources produce of 210 thousand tonnes of fish annually at the rate of per capita per day availability of 18 grams. In fact, demand for fish is quite large. The extent of exploitation of the aquatic resources of the region remains quite low. Of the total 20398 kilometers of the riverine aquatic source, very little is presently being harnessed for purpose of fish production. Even the major portion of the Brahmaputra with about 780 kms of its length passing through Arunachal Pradesh and Assam and fed by over 42 tributaries has remained by and large untapped. One of the reasons being steep gradient of the river coupled with strong current thereby rendering commercial fishing with the existing techniques difficult. Fishing in the Brahmaputra basins is thus done in marginal areas where the river gets divided into several channels[2]. Majority of small rivers

[2]Working Group, Zonal Planning Team, Agro-climatic Regional Planning for Agricultural Development in the state of Assam, Eastern Himalayan Region (Zone 2), Assam Agricultural University, Jorhat-13

and streams in the region are lying nearly fallow. Certain areas in Nagaland and Arunachal Pradesh are suitable for stocking cold-water fish like trout. Lack of regulatory measures for conservation of fish stock and industrial pollution are added constraints on the development of fishery sector of the NE India.

There is vast scope of increasing fishery production by efficient and rational management of the existing reservoirs and by taking up new reservoirs wherever new hydroelectric projects are set up.

The most important fisheries resource in the region is the lakes and *beels (143 thousand ha)* but this resource has considerably shrinked due to excessive silting, breaches caused by floods and excessive growth of weeds. At present, the average productivity of fish is hardly 180kg/ha per year against its production potential of 1000-1500 kg per ha. It is possible to enhance the production of lake and beels to over one lakh tonnes annually even by a modest productivity of 600 to 700 kg/ha. Majority of the ponds and tanks are either underutilized or utilized unscientifically. There are about 44000 ponds and tanks, which yield 0.5 lakh tonnes of fish. Thus, even without the riverine aqua resources, the beels, lakes and ponds together are capable of fulfilling the present requirement of 1.40 lakh tonnes of fish in the region

Constraints to development of livestock and fishery sector: There are several constraints to development of livestock and fishery. Some of the major constraints identified and discussed below:

1) There has been a sharp decline in area under permanent pasture and other grazing land in the region. Moreover, there is hardly any plan to grow fodder for the cattle. This has caused severe shortage of fodder

2) The illegal encroachment of village grazing land for cultivation is the main reason behind declining area under pasture and other grazing land

3) Rehabilitation of erosion and flood-affected people in the grazing land also reduces grazing land

4) Production of milk per animal in Assam is very low (only 0.87 kg). This could be attributed mainly to large number of indigenous and non-descript cattle

5) Poor quality and lack of proper livestock feed is a great impediment in enhancing livestock productivity in this region. Only a few number of feed mills are in operation in the region, which are unable to produce quality animal feed and meet the demand for feed

6) Virtually there is no plan to develop beef cattle in the hilly states where beef constituted the major share of animal meet. Generally the old and culled animals are bought from other states of the country to meet the demand of beef cattle in the hilly states. This is an important issue, which should be properly addressed to

7) The crossbred cattle usually give good yield in the first generation, though in the subsequent generations, the productivity diminishes unless a new stock is crossed with an improved pure breed. Moreover, stall-feeding of animals is not an acceptable proposition in the rural households mainly due to lack of animal feed and its high cost

8) During the 1950's to 70's, there used to be ' *khuti*' or '*Bathan'* system everywhere i.e. large herd of buffaloes kept primarily for production of milk. However, with the shrinkages of swamp, marshy area and grazing land, a large number of these *Khutis* and *Bathans* disappeared

9) Goat and sheeps are not only reared unscientifically but practically no attention is given to these non-bovine animals. These animals are not reared commercially although they have great potential in almost all the N.E. states

10) Pigs on the other hand are kept by tribal and in some cases schedule caste people. Religious taboos discouraged pig rearing and poultry farming among the Hindu caste families

Fishery Sector

The major constraints in fishery sectors are listed below:

1) In most of the water bodies, fast growth of water hyacinth and other weeds and heavy siltation year after year has destroyed the ecology and affected fish production.

2) The river system in the region and other water bodies is critically short of stocking of fish. The feeding channels of most of the beels are lost due to construction of dam and embankments. This has connected the *beels* from the rivers.

3) There are hardly any efforts by the government agencies to reclaim the water bodies or attempt for fresh stocking in rivers and other water bodies. The leaseholders try to exploit these water bodies as much as possible but are least bothered about making any improvement.

4) Most of the river and other water bodies are deficient of nutrients, which in turn adversely affected the growth of fish.

5) There is always apprehension in the minds of the fish farmers on making any fresh investment that recurrent flood might wash away their efforts. Moreover, there are incidences of frequent theft even on private fishery units.

Prioritization of the Strategy for Development

The broad strategies needed for the NE states for developing the livestock and fishery sector are drawn and listed below:

Livestock

1) Development of local and non-descript stock through artificial insemination programme be taken up more vigorously. The local stock should be improved in a phased manner and total replacement of first and second-generation stock with the freshly improved breeds to maintain productivity of milk. At the same time, quality of pure breed animal should be maintained by the Veterinary Department so that they can be used in the process of AI programme as and when required. This will also ensure commercialization of dairy farming in this region

2) Chilling plant and other infrastructure facilities needs to be created to handle storage and marketing of milk and other livestock products

3) Feed mill should be set up in all the district headquarters for easy availability of animal feed

4) Database on livestock sector should be maintained with all details. This will not only help in planning but also throw light on the performance at different levels

5) Veterinary extension service needs to be strengthened in all the NE states. In most cases the rural households are yet to receive the services of different field functionaries.

Strategy for fishery development

1) The existing water bodies, which are in most dilapidated condition (viz., beel, lakes, ponds etc.) should be cleaned and reclaimed to create effective area for fish cultivation and this would require massive investment

2) The rivers and other bodies should be properly stocked with fresh seeds to minimize the extent of fallow

3) Necessary realignment of existing embankments along the river is necessary so that contact channels with the beels and other water

bodies may be reestablished. In the event of flood, the excess water also would be stored in closed water bodies. This would help auto stocking of fish in the beels and other water bodies. Fishery department, in consultation with flood control department, may also take necessary action in this direction

4) Production of fish seed especially to meet the demand of private fish farmers should be taken up in each circle headquarters. The government of Tripura has already been supplying the required fingerlings to the fish growers

5) There is scope to develop sizeable area from cultivable wasteland and part of which could be brought under fish farming. This would require investment on reclamation and development. Respective state governments may look into this aspect

6) Taking up of private fishery on commercial line should be encouraged. Of late, people have shown lot of interest in fish farming in the backyard of homestead. Given necessary infrastructure, fishery would turn out to be a very profitable business since there is market for the product

7) Appropriate policy intervention is necessary from respective state governments to impress upon the leaseholder so that they not only exploit the harvest but also maintain and manage the water bodies and rivers

8) Fishery extension service should be revamped and strengthened so that technology available can be properly disseminated to farmers

9) A serious limitation in fishery sector is a very poor database. Efforts should be made so that a detail and reliable data on various parameters on fishery is maintained at block level

10) Jagiroad in Assam has one of the biggest dry fish markets in the country where dry fish from other states are brought and sold to different NE states.

11) Appropriate prophylactic measures need to be taken to check further outbreak of Ulcerative Syndromes in the NE states. Because few years back this deadly disease has virtually broken the backbone of fishery sector in the northeastern India

12) An integrated rice-fish system must be developed to sustain the farm income and provide necessary household nutritional security[3]

[3] Details in tables are available with the authors

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7 STATUS OF ANIMAL HUSBANDRY AND VETERINARY DEVELOPMENT IN MEGHALAYA

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Meghalaya (literally the abode of clouds) attained statehood on 21 January 1972. The state was carved out of erstwhile Assam and came into existence as full-fledged state. The state is land-locked territory of lovely hills and abounding sylvan beauty and natural resources. It has a temperate climate and rainfall is high. North, south and western border are comparatively warmers in winter due to lower altitude. It has four distinct seasons, spring time (March-April), summer or rainy season (May-September), Autumn (October-November) and Winter (December-February). The total area of the state is 22429 square kilometers, most of which is hills with a population of 1774778 (1991). The density of population is 79 with 81.4 per cent in rural areas and 18.6 per cent in urban areas. The sex ratio is 955 female. Predominantly inhabited by tribal population consisting of 85.5 per cent S/T and 0.51 per cent S/C and 13.9 per cent general population. The Khasis, Jaintias and Garos are the main tribal group. There are seven administrative divisions/districts in the state. About 49.1 per cent is the literacy rate ranging from 81.74 per cent urban and 44.85 per cent rural literates. The main workers are 40.3 per cent of which 55.3 per cent cultivators and 12.5 per cent agricultural workers. The participation of womenfolk in the economic activities is predominantly in the state. Per capita income is about Rs 5519 and the population below poverty line is 33.87 per cent (1999-2000). The population of the state is mostly meat eaters and the consumption of milk is negligible. It indicates the need for requirement of livestock product in the state.

The mode of cultivation is mainly hill terrace farming, but the productivity is low. The agricultural economy of the state is characterised by subsistence nature. The livestock population is dominated by cattle with 6.98 lakh indigenous and 16.8 thousand crossbred cattle. Pig population is also substantial at 2.94 lakh, the next is 1.96 lakh goats and the poultry; desi 1.68 lakh and only 4.5 thousand improved poultry. There are a few number of ducks, drakes and ducklings about 45.4 thousand. The veterinary service facilities in the state are not satisfactory.

Livestock Production

The state is perennially deficient of livestock products. The total short fall is 7.3 thousand tons of beef (total requirement 28.8 thousand tonnes), 900 tonnes of pork (total consumption 8500 tonnes), 32 million eggs out of total requirement of 1116.7 million. The consumption of mutton and chicken is negligible. In order to promote the sector to meet the growing demand for livestock product, the trained manpower is also scarce.

Status of Livestock Diseases

Coccidiosis and Ranikhet diseases are the most epidemic diseases with 13626 attacks and 522 deaths, and 5895 attacks and 456 deaths respectively in 1999-2000. The next important disease is chronic respiratory and swine fever. The foot-and-mouth disease, fowl fox and rabies are other important diseases.

Problems and constraints

Being a hilly state most farmers practice shifting cultivation and the food production is perennially deficient of its growing demand. This in turn affects the supply of the livestock feed ingredients. Thus, the livestock production stands as backyard venture rather than an economically viable enterprise. On account of scarcity of feed, the farmers are unable to take large, scale livestock production.

Mineral resources generate sizable revenue to the government, which is also not reinvested in other sectors. But the externality of mining activity in terms of man-made problems of water scarcity adversely affects the crops and people and livestock.

The household stock of livestock population is extremely low and the houses are scattered making vaccination of the common disease extremely difficult. Lack of proper road and communication made it difficult to reach the people in the time of crisis, which aggravate the situation.

8 PLANTATION CROPS IN NORTH EASTERN INDIA: CONSTRAINTS AND STRATEGIES

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Plantation crops are high-value crops of great economic importance and provide huge employment opportunity, specially to the women throughout the year. The sub-tropical climate of Northeastern India is extremely favourable to the cultivation of many plantation crops. Among the three important crops viz, tea, coffee and rubber, tea was introduced in Assam and Tripura as an industrial crop during the middle of nineteenth century, which has spread to other non-traditional states in the region in recent years. Suitable land and climatic conditions provide favourable environment for tea, coffee and rubber plantation in Arunachal Pradesh, Manipur, Meghalaya, Mizoram and Nagaland, but it is not fully exploited. At present 3.33 lakh ha area are under these crops in the region, which is a major source of revenue to the economy of the states. The data reveal that out of 14.6 per cent total geographical area under cultivation in the region, the plantation crops cover only 8.97 per cent, of which tea alone covers 7.5 per cent (2.79 lakh ha), rubber 1.20 per cent (4419 ha) and coffee only 0.27 per cent (10.1 thousand ha). The share of tea is the largest, covering 85 per cent of area under plantation crops. Historically, the cultivation of tea being a corporate activity, the involvement of common farmers was totally absent in the past, but in the changing environment, a marginal presence is seen with a total area of 40.0 thousand ha in the small-scale sector. The development of this emerging phenomenon of small-scale tea cultivation in Assam attracted the non-traditional states to introduce it as cash crop among the small farmers.

Assam is the largest producer of tea in India (about 53 per cent of total production). Its share in the region is about 96.8 per cent of area and 98 per cent of production. The productivity of tea is about 1850 kilograms per ha.

Coffee was introduced in NE states during 1960s. The implementation of the scheme of expansion of subsidy of Coffee Board Of India in 1979-80 has helped in increasing its area. The Assam Plantation Crops Development Corporation took initiatives to establish coffee and rubber plantation in the

North Cachar and Karbi Anglong districts. Presently, the NE states have a modest coverage of about 10.1 thousand ha of coffee plantation and 44.7 thousand ha of rubber plantation. The cultivation of coffee and rubber helps checking soil degradation in the hill slopes.

Rubber occupies 44.72 thousand ha in NE India, which is about 8 per cent of the total area at the all India level and produces 2.28 per cent of total rubber production in the country. Though the entry of this crop started on experimental basis during 1950s, but gained momentum only after 1985 through the project “Accelerated Development of Rubber Plantation”. Presently Tripura alone grows 25.38 thousand ha of rubber, which is 56.7 per cent of the total rubber area in the region.

Plantation Crop Based Farming System

The monoculture in small holdings is a nightmare during the year of slump and epidemic of pest and diseases. Raising more than one crops alongwith a particular plantation crop not only reduce the gestation period but also ensure steady and higher farm income even in the period of slump. Seasonal crops like vegetables in the formative years of the plantation crops and permanent crops like orange, arecanut, agar, tree beans, black pepper, gooseberry etc. could be grown in the matured plantation to augment productivity and profitability. Intercropping also stands as insurance against crop failure and price slump.

Premium Organic Farming

The organically, grown products have been gaining popularity worldwide and fetching premium price both at the domestic as well as international market. Since the virgin soil in the hill areas is favourable for tea cultivation, the natural production condition in the NE India could be highly gainful in the production of user-friendly tea. On account of high amount of organic matter and other plant nutrients in these soils, the plantation crops can be grown organically with minimum of agro-chemicals. The strategy to produce organic tea and popularize among the consumers would pay high dividend. Such innovation in value-addition of tea is potentially economically remunerative and helps conserve the precious soil and water resource.

Constraints

The cultivation of these plantation crops in the region has been traditionally a corporate activity. The production system is also highly knowledge intensive and scale biased. Therefore, the expansion of small-scale tea in the recent period confronts number of constraints including lack of

information and extension services, timely supply of processing facilities and lack of required knowledge of agronomic practices. Inadequate training infrastructure to prepare the required skills among the farmers is also a reason for slow growth. Thus, the early stage of transition in the plantation economy requires effective planning strategies.

The post-harvest management in plantation crops is very crucial. The green leaves require quick processing facility and then necessary market facilities must follow, or else there could be total loss of production due to quality deterioration.

Perfect knowledge is essential in every stage of the production of tea; viz, production, harvesting, processing and marketing. Hence information technology becomes crucial. Capital requirement is particularly very high in the initial period. The common farmers find it difficult to invest the high amount without adequate institutional financial assistance, which is essential for the promotion of small-scale tea cultivation. In recent years, Tea, Coffee and Rubber Boards have introduced a number of schemes to promote the crops under small sector. NABARD also assists the tea growers. But in-depth studies on the subject is severely lacking. It makes the information system on the knowledge on financial requirement, availability of credit and other constraints extremely scarce.

There is vast scope for expansion of tea, coffee and rubber in the region. Adequate policy support is needed to intensify small-scale cultivation of these crops in suitable areas. The production of tea could be enhanced if certain management practices are improved. The commodity boards such as Tea, Coffee and Rubber Boards have already taken various schemes to popularize respective crops in the region. More promotional schemes are essential as majority of the existing large tea gardens in Assam have crossed the economic age and some are over 70-80 years old. As a result, this has caused steep shortfall in production of tea. Thus scheme of replacing the older trees and replanting or expansion planting should be implemented. If the system is modernized and adequate technological changes are brought about, the sector could enhance the export earnings substantially.

Cluster Village Plantation: Emergence of Small-scale Tea Cultivation

With the emergence of small-scale tea cultivation, the nature of technological requirement has changed tremendously. The demand for efficient plant type, improved crop management practices and post-harvest technology would grow substantially in due course of time. This would require concerted effort in terms of private-public interface on R&D including the promotion of

delivery system. The prestigious corporate bodies should invest more on effective demand-driven R&D on these crops. The limitation of the plantation crops is that processing is time-demanding and urgent. The harvest must be processed into marketable forms within a specified time to preserve the quality. Thus growth of plantation sector must be tagged with the establishment of processing facilities including marketing network and infrastructure. These units have to be centrally located around the large number of small plantation units and managed by the stakeholder groups. Since the processing units are capital as well as skill intensive, it is inaccessible to the small farmers. The cluster village approach and the farmers' cooperative management system could be a viable proposition.

Studies show that only 2.5 per cent small farmers received institutional financial support, which needs to be enhanced for the betterment of the sector. This requires appropriate intervention and public sector support. Marketing is the most critical deficiency in the region particularly for the consumer products like tea. The existing private participation in marketing is exploitative and public interventions weak. As the access to processing facilities is limited within the producer's proximity, the small producers have to transport the green leaves at least 6-8 hours by road, which causes quality deterioration. The public sector marketing infrastructure is almost non-existent in case of coffee encouraging the middlemen to snatch the lion's share of the produce. In case of rubber, the Rubber Board is now trying to establish the market network. The long gestation period of the plantation crops locks up the initial investment till the commencement of the economic yield. Shorter gestation varieties are required to help quick recovery of returns to investment and attract more producers. In addition, the scarcity of plantation material even for the existing technology is also severe. The adequate supply of suitable planting material for the diverse agro-climatic is a major challenge. Transportation facility is a hurdle to plantation crops in the region. Perhaps properly, managed transport subsidy for these products could be planned.

The strategy of Build, Operate and Transfer (BOT) of the processing facility and other infrastructure for plantation crops is needed in the public sector particularly to help the small-scale sector. Hilly areas need special consideration in the regard.

Research Needs

The identification of proper cropping system for plantation crops requires more research initiatives. The companion crops along with plantation crops as base crop, must have varying morphological frame and rooting habit for minimum competition for space, light, moisture and nutrients. Further, the selection of host crops is crucial or else it attracts pests and diseases. The

promotional activity in the sector should take cognizance of local needs, knowledge network, agroclimatic condition and market facilities in a multi-pronged manner.

Conclusion

Plantation crops are highly income generating if managed properly. The cultivation of these crops was traditionally limited to corporate sector. The corporate revenue however, did not percolate down to the benefit of the society. Although, the region occupies a strategic position as the highest producer of tea in the country, the social gains due to the corporate agriculture is negligible. The changes are taking place in the recent years, resulting in the emergence of small-scale cultivation of tea. The implication of this development on the farm income has been significant. There are, of course, several inherent problems of small-scale cultivation of plantation crops like capital lock up due to long gestation period, capital intensive nature of production system, processing and marketing problems. The solution to these multi-dimensional problems requires effective state intervention. The farmers also face the problems such as quality deterioration of green leaves due to delay in processing and locational disadvantage of tea processing units. The capital infrastructure facilities such as processing units need to be located in the site around the cluster of smaller plantations and the production management by the cooperatives of the user groups. A cluster of village model may be encouraged to grow particular type of plantation crops, viz, tea, coffee or rubber so that processing can be done in the central processing units. The location of the central unit should accompanied by the infrastructure facilities like electricity, water, road and marketing network. The ancillary infrastructure such as regular supply of raw materials, inputs, agro-chemicals and other requirements must be available. In view of existence of customary laws and property ownership rights prevailing in the tribal societies, such a socially acceptable arrangement could substantially benefit the hill states.

9 STATUS OF RICE PRODUCTION SYSTEM IN ASSAM: A RESEARCH PERSPECTIVE[1]

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Introduction

At present, rice occupies about two-third of the total cropped area in the state. Being the single major source of agricultural GDP, rice plays a significant role in the state economy. Further, its importance in the consumption basket (the average monthly consumption per capita is about 13kg) also speaks volumes on the rice orientation of the state. Another specialty is that the rice is traditionally-grown throughout the year viz. winter, autumn and summer seasons, with winter (*kharif*) rice as the main crop. Assam occupies a special place in the rainfed rice production system in the eastern India (being a major rainfed rice-growing area) by covering about 9 per cent of the total rice area and contributes 8 per cent to the production. At the national level, the state contributes over 5 per cent of rice area and 4 per cent of rice production.

Though Assam produced about 3.4 million tonnes of rice in 1997-98, the state is deficient to the tune of a million tonne making the state a net importer of rice. Continuing deficiency of the major food item is a critical issue of food and nutritional security, causing concern to the policy makers. The productivity of rice has stuck a low at 1.35 tonnes per ha, well below the national average of about 2 tonnes. The regional and zonal disparities in the rice production system are also very intriguing. It is thus imperative to undertake an in-depth study of the changes in rice economy in the state[3].

[1] Abridged version of a paper presented at the 4th workshop of the NATP project RRPS2 "Socio-economic dynamics of rice production system in eastern India" at the Central Rice Research Institute Cuttack, 9-11 July 2001

[2] Dr Bhowmick provided the time series data on area, production and yield.

[3] This study has been taken up as part of the larger study under NATP funding entitled "Socio-economic Dynamics of Changes in Rice Production System in Eastern India".

The objectives of the paper are to understand the evolution of rice production system since independence, examine the modern technological scenario in different agro-ecosystems, test the hypothesis of inter-zonal disparities of performance of rice technology and to identify the policy interventions in agriculture.

The relevant data from secondary sources have been utilized in the present study. Various publications and issues of Directorate of Economics and Statistics, Government of Assam and Government of India, CMIE, Ministry of Rural Areas and Employment and CRRI, Cuttack have been major sources of secondary data.

This paper has been broadly divided into two sections. The first section provides the trends, growth and instability, cropping pattern, the status of improved technology, yield gaps, risk in rice and rice research at the state level. The second section presents the disaggregate analysis of agro-climatic zones. The zonal analysis is carried out based on original undivided 10 districts of the state. The disaggregate analysis contains the share of rice by seasons, growth and stability and performance based ranking of the zones. An Agricultural Development Index (ADI)' is calculated using nine indicators namely, credit, irrigation, HYV area, fertilizer consumption, road length, rural literacy, labour availability, labour productivity and infant mortality and regressed with rice yield across the seasons. The factors are aggregated into the index for each of the zones as a unifying measure to simplify the analysis. The indices (FI) of the individual factors are aggregated into ADI. The following formula is considered for the construction of the index.

$$FI = \frac{\text{(Value of factor for a zone-minimum value of factor over all zones)}}{\text{Range of values of the factor}}$$

$$ADI = \Sigma\ FI)\ X\ N\ /\ 100, \text{ where } N = \text{number of factors}$$

The State Profile

Trends through 1950s: During fifty years since independence, the area under rice increased by about 64 per cent, while the production has more than doubled registering about 116 per cent growth, mainly on account of area expansion. The linear growth rate of productivity is barely 38 per cent during this long period, which is quite low. Winter (*kharif*) rice dominates in both area and production, followed by autumn (pre-*kharif*) rice and summer (*rabi*) rice. But, the share of winter rice declined from 78 per cent in 1952 to 66 per cent in 1999, though the absolute area shows an increment of about half a million ha. The area share of autumn rice remained constant while the summer crop has shown a quantum jump in growth from merely 0.27

per cent in 1952 to 10 per cent in 1999. Summer rice performed outstandingly in the last decade, recording over two-fold increase in productivity level. The incremental productivity of autumn and winter rice during the last four decades ranges from 220 to 420 kilogram per ha respectively. The yield of summer rice is marching close to the national average at 1.99 tonnes. Should not the state adopt appropriate strategy to enhance the yield of winter paddy at least to the level of national average? This is also a research challenge to crop scientists to develop required technology for the purpose.

Growth and Instability

The growth in agricultural production is essential for any economy, particularly in an agrarian economy where the food demand overstrips the supply due to population growth. In Assam, rice has been the major food in the consumption basket. However, the growth scenario of rice in the state has been quite unsatisfactory. Considering the unparallel population growth in the state, the matter requires greater attention. Figure1 clearly indicates the fact that the state has by and large fallen in a situation of **'food trap'** in the post-independent period where the growth in consumption demand of rice persistently exceeds the production growth for a longer period. The result, once a surplus state has become a net importer of rice from the early 1970s. Though there have been some achievements in the production, especially in the 1980s, the process again has weakened in the early 1990s. In this circumstance, the state must intervene by investing heavily on the strategic research on newer production frontiers so as to breakthrough the shackles of the yield barrier. Improved varieties, timely availability of seeds, infrastructural support system viz; irrigation, roads, electricity, market etc., mechanization, integrated nutrient management and speedy extension of technical knowhow hold the key to future growth pathway. The future policy should follow an integrated approach rather than often followed piecemeal approach.

Between 1952 and 1992, the total rice area increased steadily reaching a plateau at 2.55 million ha and thereafter slumped to negative growth mainly because of decline of winter rice area. It has resulted in decline of absolute rice area in the recent years. The path of growth of rice yield has been highly uneven in the state (Figure 2). Until the mid-1970s, the yield was stagnant at low level. The scenario has changed to positive growth in the subsequent period, which reached the peak of 1.31 per cent per annum during the 1980s. The growth rate of yield of summer rice however, is at an impressive rate of over 4 per cent per annum as compared to that of the winter rice yield at 1.36 per cent per annum. More adoption of high-yielding varieties, expansion of irrigation and a rapid shift in summer cultivation practices has improved the performance of summer and winter rice. But,

this growth pattern could not be sustained in the 1990s. Fewer technological options and inadequate infrastructure support affected the recent performance. The production growth followed the similar pattern as that of yield. However, the slow down of yield growth coupled with negative growth in area resulted in declining rate of production during 1990s. The variability of rice area, production and yield in the state has been moderately low. Coefficients of variation during the fifty years have remained quite low ranging from 0.03 per cent to 6.26 per cent annually (Figure 3). The highest variability was observed in production during 1960s due to rapid increase in the rice area and uneven yield trends. The phenomenon of stability at low level of rice production in the state is clear indication of stagnation. In fact, the low variability, though a desirable trait, when coupled with low level of productivity, symbolizes a sluggish nature of the performance of rice in the state. Why does the low-level yield barrier remained unbroken in the state, is another critical question?

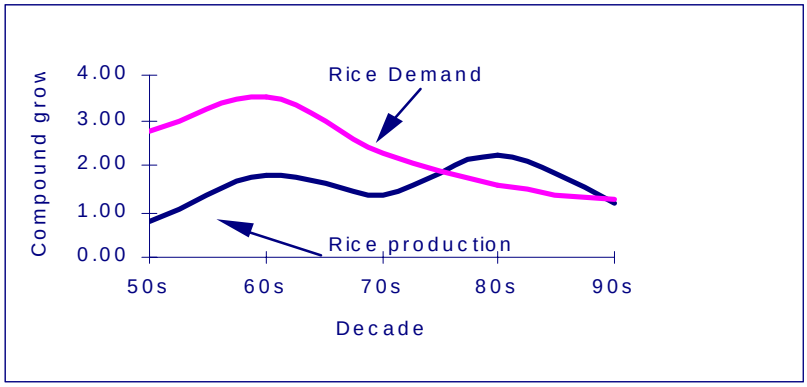


Fig. 1 : Good trap in Assam

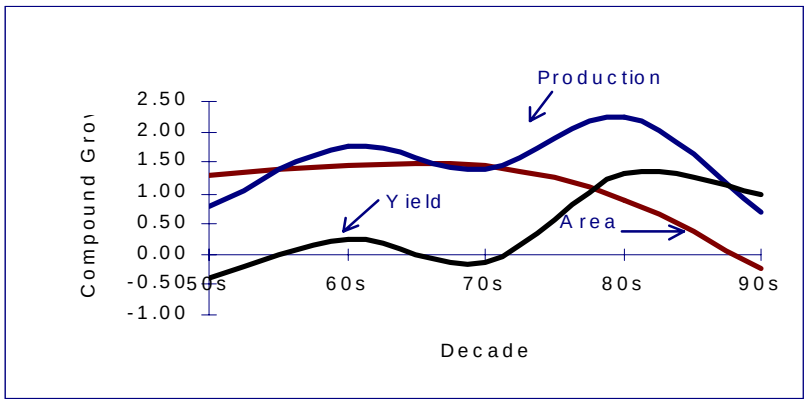


Fig. 2 : Growth scenario of rice in Assam

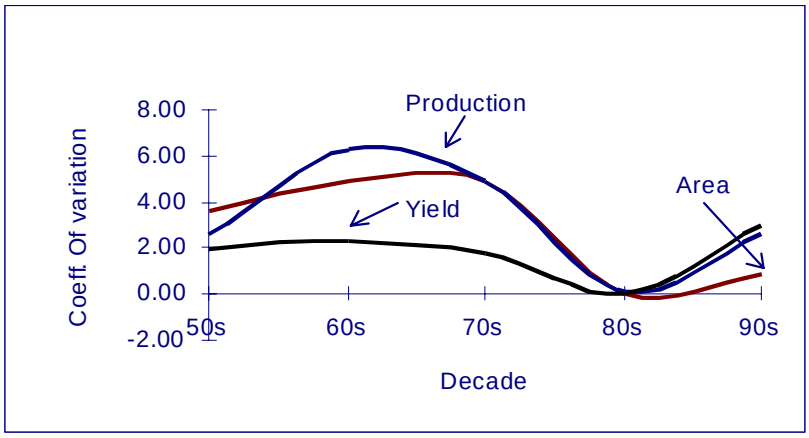


Fig. 3 : Trends in variability in rice in Assam

Cropping Pattern and Rice

Rice is grown in varied eco-systems viz. rainfed/irrigated upland, lowland, flood-free and flood-prone, medium land, deep water and hill eco-system. Among the predominant crop sequences, the following; viz, Autumn rice-winter rice–mustard, Winter rice-wheat/mustard/pulses, Jute-winter rice-vegetables and Autumn rice-winter rice are the main crop sequences followed in the rice-based production system. It is observed that diversification is taking place over the years, though the crop diversification index is heavily influenced by rice, which commands about 64 per cent of the gross cropped area. The share of rice in GCA has decreased by about 12 per cent in the last 50 years due to increase in the gross cropped area under other crops, hence the absolute rice area in the state remained unchanged by and large. In a positive side, the increase in area under boro rice has not only improved the utilization of rabi fallow, but enhance the cropping intensity to about 145 per cent. The oilseeds, such as rapeseed and mustard, and vegetables like potato have improved their position. Fiber crops particularly jute and mesta are the losers, whose absolute area has declined. Area under wheat recorded an increase, especially during mid-1980s to mid-1990s, thereafter started declining. Thus, changing cropping pattern made minimal impact in the sector.

Varietal Status

About 26 modern rice varieties are available in Assam for diverse eco-systems such as deep water, shallow water, irrigated and upland (Table 1). However, most of the varieties are released between 1967 and early 1990s and practically, no newer improved variety has come by in recent

times [in the latest list of centrally released varieties for the states, no varieties are earmarked for the state of Assam (ICAR Annual Report 2000-2001)]. The non-availability of seeds of recommended varieties is another perennial problem.

Although, the government invested to some extent on research on varietal improvement in Assam in the earlier period, but now it must invest more on R&D programmes in agriculture. The ecosystems such as lowland, deep-water have been practically ignored in the existing varietal development programme. The deep-water rice (locally called as *Boa*) is important in many pockets of Brahmaputra valley, thus improvisation of the production condition in this large-sized ecosystem is of urgent need. Most existing varieties are of long-duration and a very few are resistant to pests and diseases. Also only few modern varieties have the tolerance capacity to submergence. This is a serious issue considering the fact that most part of the state is ravaged by splashes of flood on a regular basis. Increased cultivation of *boro* paddy in *rabi* season could be potentially revolutionary, which is steadily spreading in the areas of assured irrigation. But the technological innovation for *boro* rice system needs to be followed with increased emphasis. The majority of the existing modern varieties are suitable only for *kharif* (winter rice) and pre-*kharif* (autumn) seasons. There is also need for more short-duration rice varieties so as to escape excessive rain during maturity and/or harvesting of the crop.

Table 1: Varietal status of rice in Assam

Varieties suitable for	No. of varieties	Resistance to pests and diseases	Average duration	Grown as
Shallow water Eco-system	12	Poor	153	*Kharif* rice
Irrigated eco-system	9	Poor	131	Pre-*kharif* rice
Upland eco-system	1	Poor	100	Pre-*kharif* rice
Boro (*Rabi*) cultivation	4	NA	160	*Rabi* rice

Source: Miracle rice, CRRI, 1995 and B. N Singh 2001

Increasing yield as well as yield-gaps

Increasing the yield potential of staple crops has been one of the critical challenges to the agricultural research scientists. The biological scientists have put-forth their valuable efforts in enhancing the yield potential of rice in the state to around 5 tons per ha. (in term of rough rice), nonetheless, the growth in biological yield potential is also stagnating during the last

decade (Figure 5). Bridging the gap between the biological potential and actual yield in one go is an unhill task, but an effort must be made in this direction. A success in the effort will contribute at least an additional tonne of paddy per hectare in the state. Here the extension services would play a very important role for the success of the technology. Of course, for the realization of the on-farm experimental yield, a number of interventions are needed particularly in the domain of input supply and other delivery system.

Interestingly, although the rice yield is increasing gradually, the gap between state average and the national level is also rapidly increasing posing a serious future policy challenge (Figure 4). Over the years, the gorge between average rice yield in Assam and India/ rest of India has increased from about 70 kg/ ha in 1970 to over 600 kg/ha in 2000. Increasing gaps also coincide with the poverty situation in the region. Apparently, there is high correlation between the yield gap and the poverty level (Planning Commission 2000). Should the technological solution be integrated with the socio-economic dimnsion of the problem? An introspection is essential on the choice of right technology in the region. Investments in the areas of infrastructure development and input marketing would be of great help to revitalize a non-starter green revolution. More research on socio-economic research would be useful to thoroughly diagnose the cause-effect relationship and advocate suitable policy measures to overcome this lag.

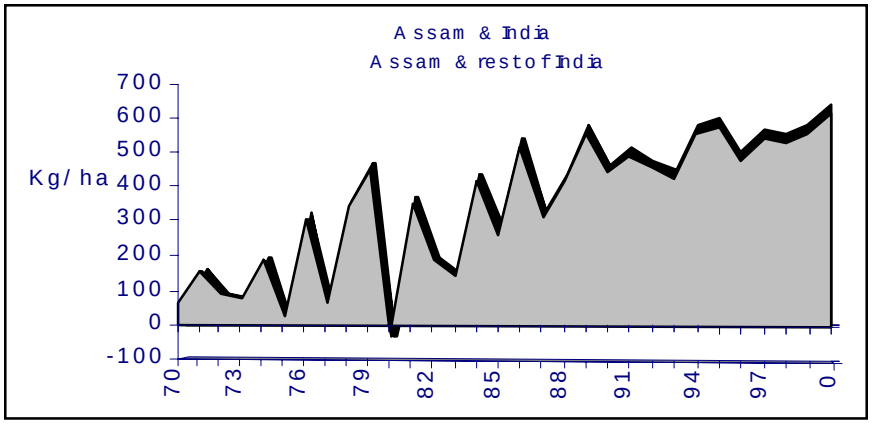


Fig. 4 : Inflating yield gaps in rice (Assam Vs India/ rest of India)

Rice and risk

High risk of flood, low and static yield characterize the rice production system in Assam. According to an estimate about 2.41 lakh ha of rice fields are chronically affected by the floods and about a lakh ha are occasionally flood affected (Table 2). Moreover, large area under the standing crop

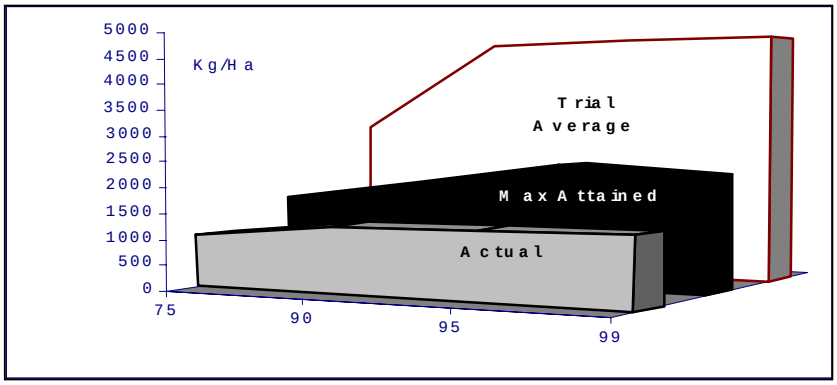


Fig. 5: The potential, actual and maximum farm yield of rice in Assam

quite often faces varied degree of submergence. Heavy rains during May to August cause flooding and affecting the winter rice is adversely in the process. More often, the flood wave coincides with the maturing and/or harvesting period of summer and autumn rice in many areas and wash away valuable output. This has an adverse impact on the farm income and more importantly on the household food security.

The undependable input supply and fluctuating area under HYV add to the risk in the state. The *Boro* is an input, intensive crop, where timely irrigation influences the yield pattern. With about 10 per cent of rice area under irrigation in the state, the yield of *Boro* rice will be constrained severely. This also limits the adoption of *HYV* at about half of the total rice area in the state. Installation of shallow tubewells in the recent years has facilitated the summer rice in limited areas, which needs expansion. Providing assured input supply, could increase in the adoption rate of HYV and likely to reduce

Table 2: Estimates of flood-prone area of Assam ('000 ha)

Agroclimatic zones	Net cropped area	Chronica-lly flood-prone Area	Occasiona lly flood-prone area	Total flood-prone area	% to net cropped area
North bank Plain	470	93	40	133	28
Upper Brahmaputra Valley	480	45	16	61	13
Central Brahmaputra Valley	295	16	8	24	8
Lower Brahmaputra Valley	920	92	17	109	12
Barak Valley	247	4	10	14	6
Assam Total	2412	250	91	341	14

Source: Hydrology and Groundwater Resource Development (1980)

Note: The figures are the averages of 1968 through 1978

variability and risk of production. Hazell (1982) suggested that the increased variability in the production is not due to adoption of HYVs *per se* but an outcome of instability in the input supply.

In addition, development of rice varieties with stress tolerance capabilities to biotic and abiotic pressure must be taken up on priority basis. A participatory policy environment by involving the local masses in conservation of rainwater is necessary for efficient utilization of water resource. Ex-ante strategies such as share cropping, crop diversification, staggered planting for flood escape, income generation through off-farm employment and other self adjustment mechanism need to be popularized in the state. This requires long-term perspective plan to handle risk arising due to multifarious factors.

Rice research in Assam

Rice research in India has been highly rewarding, generating returns close to 30-50% (Jha and Kumar 1999). But, the agricultural research in eastern India requires particular emphasis on boosting research and development efforts for rainfed (upland and lowland) rice research system.

The basic rice research in the state, though far from adequate, has mostly been confined to the varietal development and improvement. Very little attention has been paid to the crucial areas such as sustainability, ecosystem research, efficiency, marketing etc. There are few micro-level case studies at the village level or at the block level and fewer at the district level. These case studies generally pertain to farmers' adoption behaviour, gender, energy use pattern and impact assessment. The case studies are important for improving the production environment at the local level but hardly capable to address broader policy issues at the regional level. Studies at the zonal or regional level, based on homogenous agro-ecosystems, are very limited. Further, research in other frontier areas such as credit, constraints, risk management, crop diversification, efficiency, marketing and trade, export and socio-economics are necessary. These research areas are critical to Assam in the context of fast changing global agricultural order.

Analysis by Agroclimatic Zones[4]

Inter-zonal pattern of rice production: Assam is divided into six agroclimatic NARP zones comprising of ten original districts (Map 1 and Table 3). The Lower Brahmaputra Valley Zone (LBVZ) contributes maximum to the total rice area and production in the state while hill zone (HZ) the

[4] This section considers the classification based on NARP report (1991). The section considers only ten (10) original districts of the state.

Legends

1. Barak Valley Zone
2. Hill Zone
3. Central Brahmaputra Valley Zone
4. Upper Brahmaputra Valley Zone
5. North-bank Plain Zone Lower Brahmaputra Valley Zone

Map 1 : Assam by Agro-climatic zones (map not to scale)

least. However, the productivity of rice is the least in LBVZ. The productivity is satisfactory in the BVZ, UBVZ and in CBVZ in the order of magnitude.

Table 3: Zone-wise share of geographical area, rice area and production (1998-99)

Agro-climatic zones	Geographi-cal area as % of state area	Rice area (ha)	Rice production (ton)	Rice area as % of total rice area	Rice production as % of total rice production	Rice yield (kg/ha)
UBVZ	21	403512	660398	16	20	1636
Hill Zone	20	123744	173860	5	5	1404
NBPZ	18	454487	521369	19	16	1147
LBVZ	**26**	**900048**	**959017**	**37**	**29**	**1065**
BVZ	8	220294	386163	9	12	1752
CBVZ	7	352037	554025	14	17	1573
Assam	**100**	**2454122**	**3254832**	**100**	**100**	**1326**

Higher adoption of HYV and irrigated area under rice and higher fertilizer application per unit area are contributing to the higher productivity. Higher acreage under summer rice is also a contributing factor. In case of LBVZ and NBPZ, frequent occurrence of flood is hampering their performance pattern. The effect of the critical interaction among the factors is also responsible for the inter-zonal disparities. By raising the productivity level closer to the state average in these two zones (NBPZ and LBVZ), an additional 3 lakh tonnes of rice could be produced, which would potentially reduce the food deficit by over 30 per cent. Given the present resource endowment of the zones, this option can easily be adopted if necessary policy supports are provided. Improving utilization of *rabi* fallow could also be a necessary policy thrust.

Table 4: Zone-wise and season-wise distribution of rice in Assam

Agro-climatic zones	Autumn				Winter				Summer				1999 yield (t/ha)		
	89		99		89		99		89		99		Autu-mn	Win ter	Sum mer
	A	P	A	P	A	P	A	P	A	P	A	P			
HZ	3	3	3	4	6	6	7	7	1	0	1	1	1.2	1.5	1.8
UBVZ	8	12	6	9	22	25	22	26	0	0	3	3	1.6	1.6	1.8
NBPZ	22	22	22	21	20	20	20	18	4	4	11	10	0.9	1.4	1.3
BVZ	5	11	3	7	10	12	11	13	23	23	7	6	1.8	1.6	1.4
LBVZ	48	37	52	43	31	26	30	25	42	38	38	34	0.8	1.2	1.6
CBVZ	14	15	14	16	11	11	10	11	30	35	40	46	1.2	1.4	2.3
Assam	100	100	100	100	100	100	100	100	100	100	100	100	0.9	1.4	1.99

Note: A- area, P- Production

The share of rice area in the lower Brahmaputra zone is the highest, though it decreased in winter and summer in the period 1989 to 1999 (Table 4). There is not much change in the seasonal share in other zones. But, in case of summer crop, there are marked changes in the all the zones, except BVZ. Despite the fact that on an average about 17.0 thousand ha has been put under summer rice in the BVZ annually and significantly high proportion of area under summer rice in NBPZ, the performance of BVZ and NBPZ has not improved. The static productivity is once again the limiting factor in the zones. The figures 6 and 7 show zonal pattern of changes in the area.

Growth Performances

Barring a few exceptions, the growth performance of various zones in the last five decades has been identical to that of the state. Until 1970s the rate of growth in the rice area was impressive in all the zones except in NBPZ where the growth rates started increasing after 1970s (figure 10 & 11). During 1990s, the growth of area showed declining trends and in some cases crossed the horizontal axis (i.e. negative growth). On the contrary, the growth rates of yield showed improvement during and after 1980s (Figure 8 & 9). Hill zone is again the exception, which has registered highest growth in yield during 1960s and is the only region that looks promising during 1990s. However, on the whole, the yield growth seems to stagnate around 1.5 per cent in most of these zones. This endorses the general perception that green revolution has bypassed the state even at the zonal level. The decadal growth performance has been uneven and associated with substantial variability. The variability is much higher in case of summer crop as the crop is highly dependent on the input availability. As already indicated earlier, many factor interactions are responsible for the inter-zonal disparities in the performance. It is observed that the simplified index[5] form (termed as agricultural development index ADI) provides a fair idea of the probable causes of the diverse performance of the zones. The ranking of the zone based on the index shows, as expected, that the flood-prone zones are highly disadvantaged and ranked the lowest, where yield is the lowest. Figure 16 to 18 sketches the simple relationship between the ADI and yield in six agro-climatic zones in Assam by season. A closer look at the factor interaction at disaggregate level is needed to understand the causality of the disparities.

Conclusion and Policy Issues

The rice has a historical significance and cultural relevance in the state of Assam, apart from being the staple food. Despite its importance in every

[5] *kindly refer back to Data and Methodology section*

sphere of the agrarian economy, the performance of crop in the recent years has been unsatisfactory, which made Assam a net deficit state. The green revolution totally bypassed the state in the past, although some spillover effect may be seen during and after mid-1980s. The poor performance is caused by lack of required infrastructure support system and policy environment. The average yield of rice stands well below the national average. The growth path has been uneven and perpetuating the peculiar phenomenon of stability at low level of production trap, which is required to be eliminated. The sluggish growth of the crop is the result of production trap. The supply of technology, infrastructure, material inputs are the important governing factors for the betterment of rice production system, which are grossly inadequate at present. However, the sign of innovativeness of the farmers has been noteworthy, especially in the recent decade. The rapid expansion of high potential *Boro* cultivation of rice in the *rabi* season is a sign of improvement in the situation. Nonetheless, they have to be adequately nurtured through suitable input supply and better policy environment. The calculation shows that by enhancing the present level of productivity to the national average level, the state can produce at least a tonne of additional rice annually. The neglected zones like BVZ and NBVZ together can produce about 30 thousand tonnes of rice, if the productivity is enhanced.

There are disparities in the performance among the agro-climatic zones in the state. Broadly on account of the interaction effect among socio-economic and agro-biological factors has caused the uneven performance over the zones, which is rarely understood. That is why, the region with larger share of rice area and production such as LBVZ, is showing dismal yield performance. Noticeably, the performance of the summer rice (*boro*) has also been uneven in all the zones and no definite pattern of growth is observed, probably due to its high dependency on the input availability, especially irrigation.

The results of the study suggest greater emphasis on the research and development initiatives, specifically on socio-economic and policy research. For the purpose of enhancing future growth, strengthening the information system and development of comprehensive database at the disagregate ecosystem level is highly recommended. Though there has been stagnation in the biological potential in rice, there still exists large yield gap of various degrees. Steady input supply and improving the knowledge dissemination service in the state would definitely help in bridging the gaps. The practice of cultivation of *boro* rice is in a budding stage in the state that needs to be nurtured through adequate irrigation network and more technological support. This would help gainfully utilize the vast tract of *rabi* fallow and improve cropping intensity. Reforms on the weaker input-output delivery system is also required for effective promotion of the system.

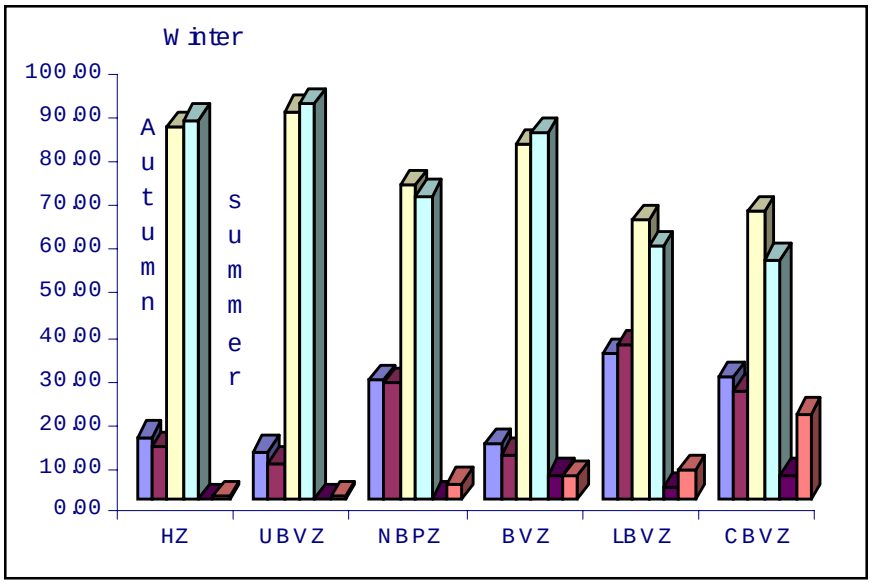


Fig. 6: Intra-zonal seasonal share (%) of rice area (1989 and 1999)

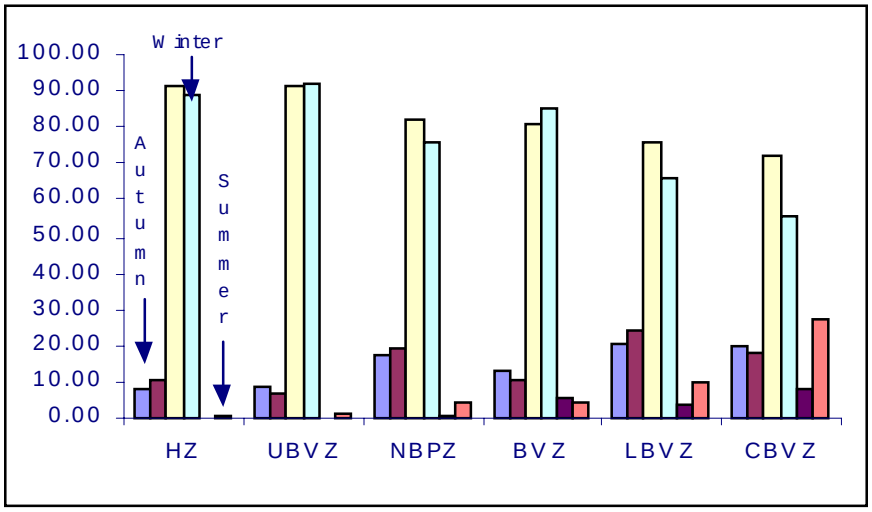


Fig. 7: Intra-zonal seasonal share (%) of rice production (1989 and 1999)

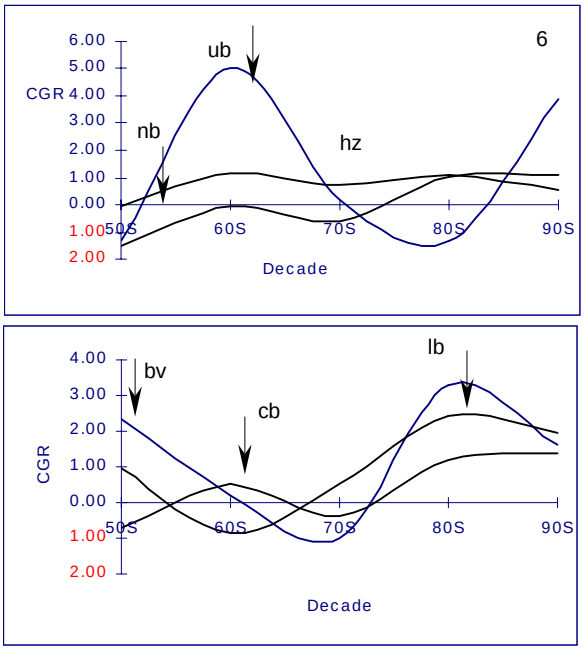


Fig. 8 & 9 : Zone-wise total yield growth pattern in Assam

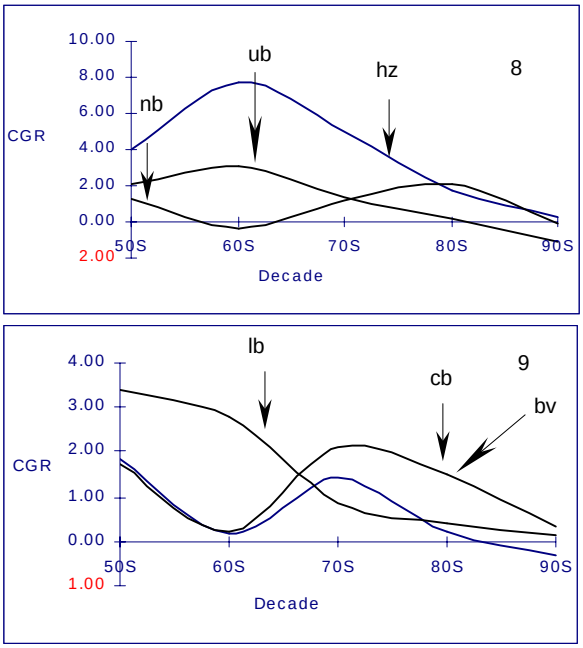


Fig. 10 &11 : Zone-wise growth pattern of rice area in Assam

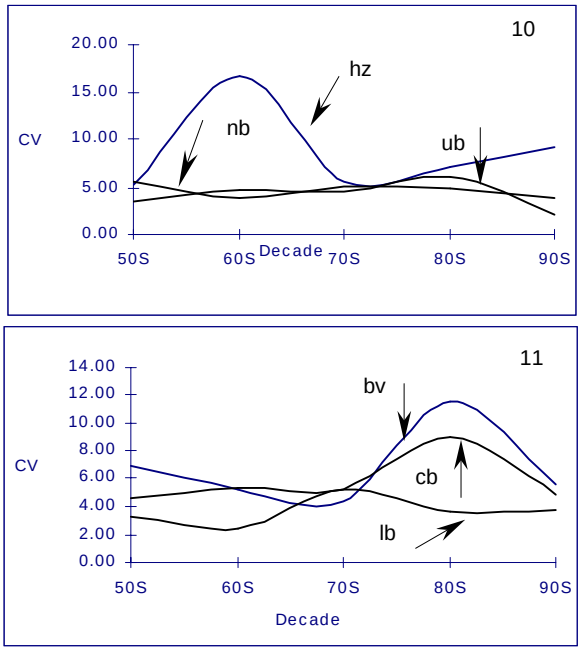


Fig. 12 & 13 : Zone-wise variability in total rice yield in Assam

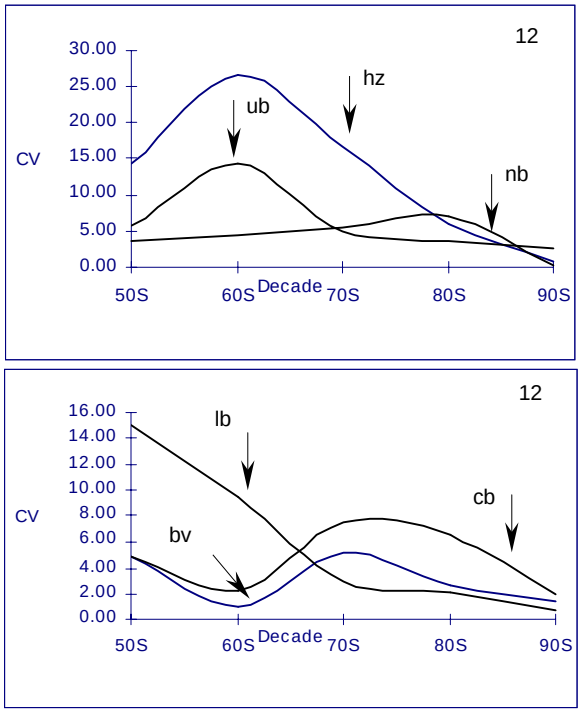
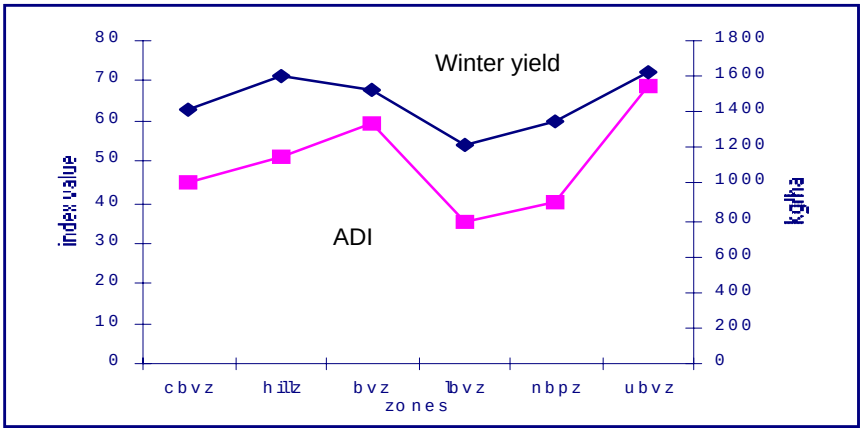
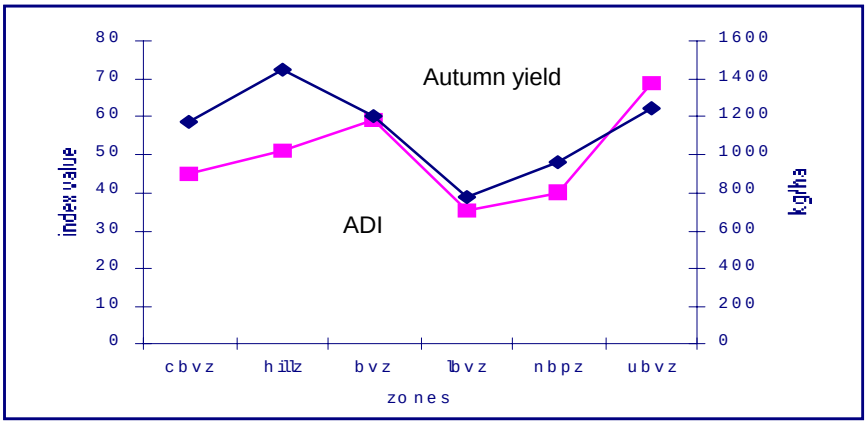


Fig. 14 & 15 : Zone-wise variability in total rice area in Assam





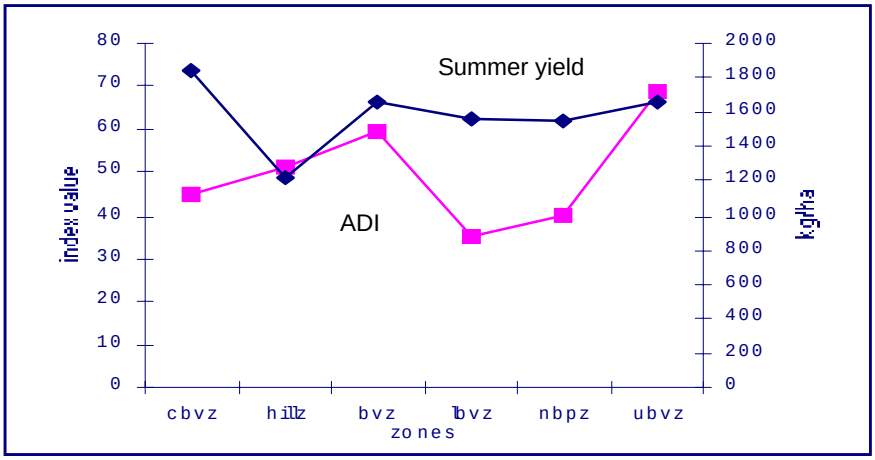


Fig. 16, 17 & 18 : Zone-wise ADI, winter yield, autumn yield and summer yield

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10 TECHNOLOGY DEVELOPMENT AND ITS IMPACT ON FARMERS' FIELDS

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Using the technique of Rapid Rural Appraisal and Participatory Rural Appraisal (PRA), various aspects of demand-driven technology are screened by the Zonal Research and Extension Advisory Committee at the Assam Agricultural University. It resulted in development of situation-specific varieties, testing and recommended package of practices in agriculture.

Varietal improvement programme: The *kharif* or winter rice as the major crop in Assam is entirely dependent on rainfall and as such it is subjected to vagaries of monsoon such as flood, drought etc. with resultant crop damage or delayed planting. To cope with such situation, the university has developed rice varieties that can withstand submergence by flash flood for a period of 7-15 days (Table 1). Under delayed planting situation a photosensitive rice variety having staggering ability is developed (Table 2). Both the varieties are on the pipeline for release and await field demonstration in the next few years.

Table 1 : Survival percentage and yield performance of three promising submergence tolerance lines developed at RARS, Titabar

Designation	Survival (%)			Yield (kg/ha)		
	TTB	Chintamoni**	Bosa**	TTB	Chintamoni**	Bosa**
TTb202-3	71	80.0	90	4720	5088	4260
TTB202-4	71	85.6	95	5010	4352	4522
TTB202-25	69	84.5	89	4780	5659	4520

*Under artificial tank –7d-old seedling submerged for 10 days under 50 cm of water, ** Under natural flood water with varying degree and days of submergence

Table 2 : Performance of rice variety Prafulla (TTB283-3-38-3) under staggered planting.

Variety	Duration	Yield (q/ha)			Grain type
		Seedling age (days)			
		(July 20)	(Aug.20)	(Sept 15)	
Prafulla	155	4500	3900	3400	Medium Bold

The crop varieties developed and improvised at the research station are given in Table 3: A total of 64 improved varieties for 11 crops are developed and tested by the research system.

Table 3: New varieties of various crops

Crop	No. of varieties	Crop	No. of varieties
Rice	27	Jute	1
Maize	4	Brinjal	7
Pulses	4	Tomato	2
Oilseed	5	Cucumber	4
Sugarcane	5	Ridgeguard	3
		Chilli	2

Some of the outstanding varieties such as Ranjit, Bahadur, Keteki joha and Aghonibora as Sali rice, Lachit and Chilarai as transplanted *ahu* rice, Luit-and Kapilee as pre-and post-flood rice; Panindra and Padmabath as deepwater rice; Joymati and Joytiprasad as *boro* rice are popular amongst the farmers. Similarly M-27 and TS-38 of toria; CoBln 9605 of sugarcane, Pratap of moong are gaining popularity amongst the farmers.

Nutrient management: In order to reduce the cost on phosphatic fertilization, slurry method of application of P (SSP as slurry @ 10 Kg, P_2O_5ha) is found effective and economic. Application of rock phosphate @ 20 P_2O_5ha along with Phosphate Solubilizing Bacteria (PSB), significantly increased rice yield over recommended dose of P (Table 4). Because of even distribution of rainfall, kharif rice often experience drought or excess water causing partial submergence of rice fields.

Table 4: Rice yield increase by improved methods of application of P fertilizer sources

Phosphate application method	Average yield (Q/ha)	Increase over control (%)	P & Bio fertilizer cost (Rs/ha)	Additional return over control (Rs)
No phosphorus	13.71	-	0	
SSP broadcast @ 20 kg P_2O_5/ha	24.64	79.72	500.00	5465
SSP broadcast @ 10 kg P_2O_5/ha	17.84	30.12	250.00	2065
SSp as slurry @ 10 kg P_2O_5/ha	28.46	107.59	250.00	7375
RP @ 20 kg P_2O_5/ha +PSB	30.84	124.59	220.00	8565

This dissuades farmers from adopting recommended fertility management in Sali rice. To overcome this situation, integrated plant nutrient management involving Azospirillum, PSB and potassic fertilizer is evolved and successfully demonstrated in farmers' field (Table 5).

Table 5: Performance of integrated nutrient management in kharif rice

Treatment	Rice-yield(q/ha)				
	Kaliabor	Titabar	Sibasagar		
			A	B	C
Control	37.88	23.81	53.44	58.17	76.14
AZO+PSB+K	52.75	33.54	82.49	88.29	54.92

Pest management: Pest and disease control have been a challenge to agricultural planners and scientists at a time when the application of agro-chemicals is being protested by various sections of the society on the ground of environmental externality. Hence judicious use of chemicals and promotion of biological substitute for the protection of plants is highly critical. The experiments are being conducted to find desirable method for user acceptability. It is found that six to eight release of Trichogramma Japonicum and T. Chilonic @ 50,000 parasitoids/ha/week starting from 20-30 days after transplanting significantly reduce infestation of stemborer and leaf folder. Mycoparasite Beauveria Bassiana @ 10 million spores/ml dilution successfully control rice hispa, resulting increase in yield. The cost-benefit ratio for the bio-control agent is 1:7:66 as compared to 1:2:92 for the insecticide monocrotophos.

Plasticulture: Due to low temperature during December/January, *Boro* rice seedlings are stunted in growth requiring higher labour for uprooting and transplanting. Raising *boro* nursery under plastic low tunnel enhances seedlings height significantly. This technology is being demonstrated in farmers' field by the Department of Agriculture, Govt. of Assam under Assam Rural Infrastructure Agricultural Support Programme in the current *Boro* season. Low cost greenhouse-cum-rain shelter is found suitable for growing high-value vegetable crops round the year. Recommended cropping sequences for the purpose are

i Tomato (Feb-May)+Tomato (Aug-Nov)+ Capsicum (Nov-Feb)

ii Tomato(Mar-June)+Spinach (July-Sept) +Cucumber intercropped with French bean/Capsicum (Oct-Feb)

iii Tomato (Mar-June)+Capsicum(Aug-Nov) + Cucumber(Nov./ Dec-Feb)

The financial assistance is provided to popularize plastic rain shelter. During 2000-2001, DRDA provides assistance to 100-300 farmers per district to construct plastic shelter. A survey by Plastic Development Centre (PDC), Assam Agricultural University reveals that around 1500 farmers have already adopted this technology in Sonitpur, North Lakhimpur, Kamrup and Sibsagar districts.

Hill agriculture : *Jhum* method of cultivation is an age-old practice in the hill area and a sole source of livelihood. Unfortunately, the new wave has branded this people's method as anti-development and accused it as deleterious to the environment. But, there is hardly any user-friendly alternative option available to the farmers. Actually instead of attempting to eliminate, the most desirable action would be to improve the system by modern means. Based on scientific experiments the university has developed a suitable model alternative to shifting cultivation. The model (Fig. 1) includes use of manures and fertilizer, growing of field crops (Rice+seasamum+maize) along the slope, inclusion of perennial horticultural crops (pineapple and mandarin orange) and use of perennial grasses for conservation of soil and soil fertility. This model is suitable for hills with gentle slope (15-40 per cent). The model needs extensive demonstration in farmers field.

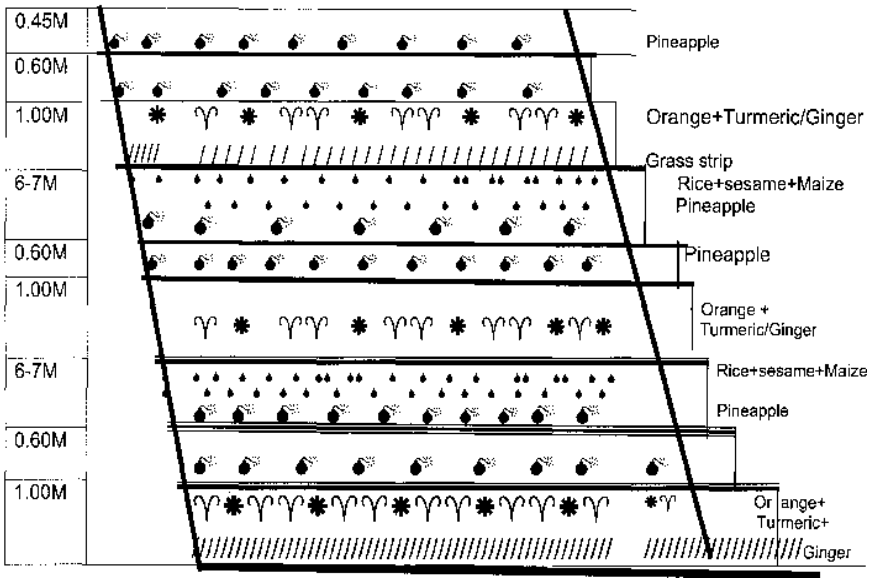

Fig. 1 : Improved model of *jhum* system

Note : on Fig. 1 : Improved model of Jhum System

1 Grow two rows of pineapple across the slope at 60x30 cm spacing

2 Raise one line of guinea grass/citronella 10 cm apart across the slope

3 Maintain a space of I metre between two rows of pineapple and grass strip to accommodate orange/arecanut and turmeric/ginger

4 Grow mandarin orange/arecanut 5m/2.75 m apart

5 Grow 1 row ginger/turmeric in the interspace along the line of orange/ arecanut

6 Grass strip is followed by 1 strip of rice/sesamum and maize. Where rice +sesamum is raised as mixed broadcast and maize is dribbled in the same strip. The width of the field crop strip should be 6-7 m.

7 The same pattern of growing is to be repeated in the entire slope. The grasses are to be cut at 10 cm above ground level at 60 days and subsequently at 45-days interval.

8 The horticultural crops are fertilized as per recommended dose. Field crops are to be fertilized at a common fertility level 40:20:20 kg N: P_2:O_2:K_2O her ha

9 Broadcast greengram/ blackgram after harvest of rice, sesamum and maize

Pisiculture : The integrated farming system approach considered gainful and increase the income generation. Integrated fish-pig farming technology is gaining popularity amongst farmers. 30-40 pigs per ha are reared on the embankment of the pond and pig wastes are drained to the fish pond where fish culture is practised without any other extraneous feed. Productivity ranges from 6000-7000 kg of fish and 3000-5600 kilograms of pigs per ha per year. Under Assam Rural Infrastructure and Agriculture Sub-project (ARIASP), 200 units of this system have already been established in the state by Fisheries Department.

Integrated rice-fish farming is another important technology developed by the university. Under this system, a small pond or a canal along the perimeter of the paddy plot covering one tenth area is constructed and suitable fish species are reared in the field along with rice crop. In order to utilize fish pond embankments fully, conserve the soil, nutrients and energy, integrated horti-fish farming technology is developed. Recommended crops for growing on embankments are coconut, banana: papaya, pumpkin and paragrass. Integration of banana alone can fetch additional income of Rs. 25,000 per ha fish farm per year besides about 10 per cent increase in grass crop yield. About 60-70 per cent fish farmers in the state have already this technology.

Impact of technology in farmers' field

Although the crops and the situation-specific production technologies are developed and recommended for use by the farmers, no in-depth study has been made to assess impact of these technologies in terms of spread or economic gain. Productivity of individual crop enhances due to technologies, although it is dependent on other factors.

In order to be popular, the technology must be farmers' friendly in terms of his farming situation, input mobilizing capacity and earn him reasonable return. Block Demonstration involving a large group of farmers is considered as powerful tool to have immediate impact on farmers. Frontline Block Demonstration (FLBD) Programme in rice executed by Regional Agricultural Research Station, Titabar has tremendous impact on adoption and spread of rice varieties viz. Ranjit, Bahadur, Luit, Joymotee etc. and production technology (Table 6). Availability of required inputs of a proven technology must be ensured to have its fullest impact. Because of non-availability of bio-control agents and bio-fertilizers, the bio-pesticide technology for control of stemborer and rice hispa and INM technology in rainfed *kharif* rice are yet to take off. Unless production of bio agents and bio-fertilizers are taken up locally and timely supply is assured, these technologies would not be able to make any impact. Many a time, technology in its present form, does not have any impact on farmers due to certain drawbacks. With proper refinement the technology might have good impact. Hence, technology assessment assumes importance in this regard.

Table 6: Front Line Block demonstration on Rice
Starting year: 1990, Area of one demonstration: 8 ha (60 bighas)

No. of demonstrations	153: *Sali* 123, *Ahu* 15 and *Boro* 15
No. of FMCs covered	175
No. of districts covered	17

Varieties demonstrated		
Sali varieties	*Ahu* varieties	*Boro* varieties
Salivahara, Lakhimi, JET 8002, Ranjit, Bahadur, Poliee, Maniram, Kushal, Satyaranjan, Basundhara	Luit, Chilarai, Lachit, Gopinath	Jyotiprasad, ishnuprasad, Joymati, Gautam

Conclusion

Technology development is a continuous process requiring dynamic R & D back up support. The systematic approach to analyze the impact of recommended technologies for economic upliftment of the farming community is also most essential. Impact analysis will help the policy makers and researchers to take up future course of action. Block demonstrations involving a large group of farmers are expected to have instant impact on adoption and spread of farmer, friendly technologies. Mobilization of available resources towards extensive demonstration of a sound technology identified in forums like Package of Practices (POP) workshop will go a long way in achieving the desired impact. Inputs required for adoption of technology should be readily available. Privatization of agro-input supply may be encouraged.

11 TOWARDS RICE SELF-SUFFICIENCY IN NORTHEASTERN INDIA

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Introduction

The spectacular improvement in rice production due to adoption of high-yielding varieties (HYVs), utilization of irrigation facilities, application of fertilizer, plant protection measures and use of improved farm implements has not been realized in Northeastern states. This region accounts for 7.8 per cent of the total rice area in India while it's share in rice production is only 5.9 per cent. The average rice productivity of 1.4 t/ha is below the national average of 1.9 t/ha (Anonymous, 2000). There is also wide interstate disparity in rice production and productivity. Assam has around 73 per cent of the rice area in the region followed by Tripura (8 per cent). Rest of other states have less than 5 per cent area. Productivity is more than 2 t/ha in Manipur and Tripura, and lowest in Meghalaya and Arunachal Pradesh. Except in Manipur, rice area has increased in all the north-eastern states. The increase in rice production and productivity over past 30 years is marginal and much below the national average; most part of which are attributed to expansion of rice area mainly in the summer season in 90's. Rice self-sufficiency is only about 80 per cent in north-eastern India. Ten million tonnes of rice is annually being imported in the region from the Central Pool. Household food and nutritional security is the key issue for both the rural and urban consumers. States like Assam, Manipur and Tripura can easily produce surplus rice. Others can improve their production potential and productivity with suitable interventions.

Constraints in Rice Production

The HYVs bred for situations with assured nutrient and water supply could not largely replace the traditional land races having tolerance to local adverse growing conditions in the region. Even promising HYVs for favourable conditions could not be grown as seed of the desired varieties are in short supply and are not available on time. High humidity prevailing in the region during most part of the year causes quality deterioration of the seed. Diverse and variable rice-growing ecologies prevail even in a

small geographical area of a village Panchayat or a Block level. Upland, favourable shallow rainfed lowland, unfavourable deep-water and flood prone area, swampy land, and hilly area etc. co-exist together in a block requiring completely different problem-solving approaches.

Heavy, erratic and torrential rain causes recurrent flood in many parts of the region. Inherent poor response of the local land races to high dose of fertilizer, its poor recovery due to various type of losses restrain the farmer from investing more on fertilizer. Development of full irrigation potential has not been done properly due to various reasons. The region is rich in good quality ground-water which has to be fully exploited. Rice crops are found in various growth stages favouring perpetuation of different insects and pathogens. This frequently causes severe incidences of pests like hispa, stemborer etc. and diseases like blast, bacterial leaf blight, RTV, sheath blight and sheath rot. Insecticides and fungicides to control these are not popular and are in short supply in the region (Anonymous, 1986).

Strategies

A thorough analysis of the rice-growing ecologies, seasons, trend in rice production and consumption over last 30 years, and its comparison with other agriculturally-developed states of the country leads to identification of 6 major areas where technological intervention with the prevailing knowledge can ensure sustainable rice production for future. These are listed as follows:

Seed production, storage and distribution

1) Technological *innovation* in *Boro* rice
2) Technological *intervention* in *Ahu* rice
3) Technological *intervention* in *Sali* rice
4) Technological *intervention* in *Bao* and flood-prone rice
5) Participatory varietal selection

Seed Production, Storage and Distribution

Seed is the basic input in modern agriculture. Healthy seed producing vigorous, disease free seedlings, is pre-requisite for a good harvest. It ensures a crop free from seed borne diseases. Therefore good quality seed of the new improved rice varieties, which the farmers prefer to grow must be available at the time of sowing. Unfortunately seed of desired varieties are mostly in short supply, often reaches the farmer after the sowing

season. Due to high relative humidity prevailing in the region, the seed viability quickly deteriorates and rarely remains viable for more than a year. There is need to identify widely-grown varieties and its seed requirement for the next 3-4 years. Production of breeder seed, foundation seed and certified seed to be organized at appropriate level involving research farm, government or private seed, producing agencies and farmer. If required, other state seed agency may be assigned the responsibility of producing and supplying good quality seed. Seed storage is the major problem in the NE India. Storage facility at all the district headquarters with appropriate temperature and relative humidity needs to be developed. Seed must reach the farmer well in advance of the growing season.

Technological Intervention in Growing Boro Rice

Boro rice is grown from mid-October to June under three broad categories: rainfed flood-prone areas; Irrigated flood-prone areas; and Irrigated flood free areas (Pathak et. al, 1999). Traditionally, *Boro* rice is grown in rainfed swampy areas, which are not in cultivation during rainy season due to chronic flood problem. These areas are generally saucer-shaped and have various levels of soil saturation and submergence. Old seedlings (2 months age) are transplanted initially in the periphery. Tillers are detached from the mother culm in this zone and are used in the lower zone for planting with reducing water level. In the event of sufficient winter rain, these low-lying areas get inundated while in case of continuous dry spell, the crop in the upper ridges suffers from moisture stress. Therefore, traditional varieties with tolerance to both excess and deficit moisture predominate in this ecology. In irrigated flood-prone ecology, flash flood is a problem. However, cold spell of 2 to 3 months is the major problem in all the *Boro* growing areas. It is more acute in high elevations (650 m above MSL). Due to lack of cold tolerance in HYV's in NE states, some varieties have been introduced from Bangladesh. It is difficult to maintain the water level in uplands with light texture soils. Stemborers, case worm, sheath blight, BPH, leaf folders, rice bugs, hispa, brown spot, sheath rot, neck blast and stem rot are the important insect pests and diseases affecting the *Boro* crop. Jaya is the popular variety for *Boro* season in Assam. Other varieties with disease and pest resistance are being recommended (Table 1).

Boro rice has high potential for increased production because of abundant sunlight, control of water level in field and lesser pest problem. The breeding strategy should include developing high-yielding rice varieties with intermediate height for rainfed swampy situation, and semi-dwarf for irrigated area with stiff culm, moderate tillering ability, early cold tolerance, early-maturity, seed dormancy, and tolerance to stemborer, seedling blast, neck blast and sheath rot. The important agronomic measure is to raise successful nursery and healthy seedling under polythene tunnel in a shorter

Table 1 : High-yielding rice varieties for different rice ecologies and production system in Northeastern states

Rice ecology	Production system	Rice varieties	Constraints
Rainfed upland	Broadcast *Ahu*	Bala, Kalinga III, Govind, Heera, DR 92, Luit, Sunil	Drought and blast
	Hill rice	VL 206, Megha rice 1, Megha rice 2, RC PL 3-2, RC PL 3-6, VL Dhan 81	Blast, acid upland soil
Irrigated	Transplanted *Ahu*/ Wet season	Lachit, IR 36, IR 64, Kapilee, Saket 4, IR 50, Rasi, Gopinath, Luit, Chilrai, Satyaranjan, Vasundhara, Jayant, KD 2-6-3, Paicos 1	Vivipery germination blast, iron toxicity, hispa RTV
	Boro rice	Jaya, Tapaswini, Chandrama, Vijeta, Biplab, Mahsuri, Joyamati, Bishnu Prasad, Jyoti Prasad	Vivipery germination blast, cold tolerance, BPH
Rainfed lowland	Normal planted	Ranjit, Bahadur, Maniram, Mahsuri, Kushal, Swarnaprabha, Ketkijoha, Golak, Padmanath, KDML 105	Blast, hispa
	Late planted	Manoharsali, Biraj, Andrew Sali	Low yield
Deepwater rice	Bao	Padmapani, Panikekoa, Panindra, Padmanath, Sabita, Rayada B3, Maguribao, Negheribao	Low yield

period. This will help in timely planting of seedlings of appropriate age. This method of raising nursery ensures higher germination and lesser incidence of blast. Research is to be undertaken to develop variety-specific crop management as well as Integrated Pest and Nutrient Management (IPNM) practices. Development of irrigation facility either by gravity irrigation or shallow tube-well to expand the area in view of high production potential of the crop is needed. Since the weather at the time of harvesting is generally rainy, drying facilities are to be developed. Use of fertilizer and weedicide is to be popularized to improve the yield. Mechanization is to be adopted for ploughing, transplanting, harvesting, and drying etc.

Technological Intervention in Growing *Ahu* Rice

Advancing the sowing season by 15-30 days is beneficial in escaping rains and flooding at maturity. With the expansion of irrigated area, *Ahu* crop can be transplanted instead of direct seeding and by growing HYVs of 100-115 days duration, a major quantum jump can be achieved in rice production. By expanding shallow tubewell irrigation facilities, the area under transplanted *Ahu* can be expanded substantially. Varietal development programme should emphasize in incorporating drought and cold tolerance at early stage and grain dormancy as additional attributes. 'Vandana' variety released for rainfed upland ecology in Bihar will be suitable for direct-seeded *Ahu* in Assam. Weedicides available in the market are not yet popular. These, along with fertilizer, are to be popularized amongst the farmers. It requires emphasis on variety, specific crop management practices as well as integration of nutrition-pest-disease management. Use of pre-germinated drum seeder in puddled soil will be suitable in place of transplanted *Ahu*, and will reduce the growth duration of crop by a week. Threshing and drying facility at harvest should be developed as the period coincides with rain. Heavy rain at harvest is the major risk for the *Ahu* rice. Hence, limited mechanization for harvesting, threshing, cleaning and drying is essential without which the scope of *Ahu* and *Boro* crop is very much limited.

Technological Intervention in Growing *Sali* Rice

Sali rice is the predominant rice crop in NE India occupying about 70 per cent area and contributing 75 per cent to the production. It is grown between June-July and Nov-Dec. and is known as *Sali* or winter rice. It is generally grown in shallow rainfed lowland, irrigated, and shallow flood-prone lowland. The land is generally fertile and has high production potential. Inundation by flood water and sporadic occurrence of diseases like leaf blast, neck blast, RTV, sheath blight, bacterial leaf blight, and insect pests like stem borer, hispa, green leafhopper are the major problems. In spite of being the most favourable area, the average productivity is much below the national average. Some of popular varieties for *Sali* season in Assam are Manoharsali, Mahsuri, Ranjeet and Joha rice. Rice is found all-round the year at various growth stages in Assam favouring perpetuation of pests and pathogen. Specifying the sowing and transplanting time will help in reducing the pest and pathogen population in the off-season. The breeding programme should emphasize in incorporation of resistance to all biotic stresses mentioned above.

Variety-specific crop management as well as integration of nutrition-disease-pest management practices is to be developed and popularized. Water

stagnation is another major problem of lowland where *Sali* crop is grown. Drainage system connected to rivers and rivulets should be constructed. Fertilizer, weedicide, insecticides and fungicides are to be made available and popularized. For better yield and minimum loss, farm operations like ploughing, transplanting, harvesting, threshing and drying are to be completed in a shortest possible period to utilize the surplus labour force of the region. Limited mechanization of the operations are necessary to reduce the peak labour requirement.

Technological Intervention for *Bao* (Deep water) and Flood prone Rice

It is generally grown in low-laying areas with water stagnation beyond 50 cm for more than a month in the season. The area covered has no option but to grow *Bao* rice with very low productivity and full of risk, both abiotic and biotic. Some of the varieties grown for *Bao* cultivation are Negharibao, Dal-bao, Panindra and Maguribao.

Low plant population due to early inundation is the reason for the poor yield of *Bao* rice. Advancing the sowing season to March-April and direct seeding ensure early crop establishment and higher plant population. Agronomic practices like basal fertilizer application to tolerate submergence are to be developed and popularized. Varietal development programme should aim at incorporating both submergence tolerance and elongation ability in addition to biotic stresses like stemborer, ufra, hispa, BLB etc. Transplanting two months old seedlings of suitable variety after flood water recedes in the 1st week of September is another promising alternative. Local rice varieties like Hatipanjar, Banskathi, Mala, Manoharsali, Biron etc. are suitable for the purpose. Drainage facilities, as discussed earlier will definitely reduce the problem (Bhowmick *et al.* 2000).

Farmer Participatory Varietal Selection

Peculiarity of northeastern states lies in its diversity in rice-growing ecology and ethnic tribes even in a small geographical area. The taste and requirements are varied. Therefore, it is wise to involve farmers in selecting the appropriate varieties from a few selected good performing ones so as to suit their local need. The first 5-10 varieties from co-ordinated trials can be multiplied and a mini-kit consisting of 2 kg seed of each variety along with local checks for various duration group can be distributed at block levels and farmers' group can be invited and associated to select the best ones. This will allow the selection of location, specific best varieties and also their spread with minimal effort. In addition, it will provide feedback to the researchers about the problems and requirements of farmer.

The present day's technologies are not percolating to the farmers, as their problems are not properly understood by the researchers. The farmer's participatory varietal selection approach opens the frontier to the researcher in properly accessing the difficulties of the farmers and their requirements. Thus the research gaps whenever exist can easily be filled up.

Conclusion and Outlook

Rice self-sufficiency at household level and at regional level is the need of hour in northeastern India. Farmers should be made aware of the new rice varieties and technologies through State Extension Personnel and news media. Providing subsidy for shallow tubewell to farmers is the most appropriate policy intervention by Assam Government towards food self-sufficiency. Working with farmers through participatory approach and close linkage of various ICAR and state research organizations is needed with NGO's and State Department of Agriculture for technology transfer, adoption and feedback.

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12 AGRICULTURAL FINANCING IN NORTH EASTERN INDIA WITH SPECIAL REFERENCE TO COMMERCIAL BANKS: SOME ISSUES

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Introduction

A vast majority of people in the northeastern India still live in rural and hilly areas, whose main occupation and means of livelihood is agriculture and forest produce. The soil and climatic conditions are favorable for cultivation of variety of field crops and horticultural crops. Rich natural resources including rare species of flora and fauna, numerous seasonal vegetables, tropical and subtropical fruits and flowers are available in abundance in the region, which generate vast export potential for valuable foreign exchange and the source of capital formation.

Commercial Banks, Regional Rural Banks and Cooperative Banks are the three prominent institutional agencies providing financial assistance for agriculture and rural development in the northeastern India. Over the years, although there is massive expansion of financial infrastructure including agricultural financing in the country, the pace of development in the Northeastern India is however, not up to the mark. Although a few studies on macro aspects of agricultural credit have been undertaken, yet the specific studies to highlight the status of agricultural finance in the Northeastern India are lacking. The present enquiry is an attempt in this direction.

The present study is based on information gathered from regional office of the National Bank for Agricultural and Rural Development and local Head Office of Reserve Bank of India, Guwahati. Farm level primary information is gathered from the sample farmers of certain P.G. research at the Department of Agricultural Economics and Farm Management. Tabular analysis with simple statistical tools was used for analysing the data.

Growth of Financial Institution

The growth of scheduled commercial bank branches in the N.E.states during 1975-1991 was satisfactory with annual compound growth rate (CGR) of more than 11 per cent. Mizoram appeared to have the highest growth rate (44.34 per cent) and the lowest being 10.97 per cent in Assam during this period. The main reason for high growth rates in the N.E.states is due to low-base arising from a very poor growth of banking institutions in the pre-nationalized period. This expansion is confined mostly to the rural and semi urban areas. Limited expansion of branches was also seen in urban areas in Assam, Manipur, Meghalaya and Tripura. The population per bank branch is 15000 as compared to 14000 or less in the country during 1990-91.

Credit Deposit Ratio

The efficiency of performance of a financial institution is measured by the credit deposit ratio, where the highest is usually preferred. The analysis shows that the credit deposit ratio for the NE India is only 28.03 per cent, which is the lowest in the country (being about 55.49 per cent). The lower C.D. ratio in the N.E. India (about half the national average) implies draining out of the financial resources from this region. This indicates that the business interest of the bank was met at the cost of the public interest, which needs to be seriously looked into.

Among the northeastern states, the C.D ratio is the highest in Manipur (47.60 per cent) and the lowest in Meghalaya (19.11 per cent) during this period. Bank-wise analysis of the C.D ratio shows that in respect of RRB, it was the highest in Arunachal Pradesh (97.93 per cent) and lowest in Mizoram (28.48 per cent). In case of Commercial Banks, it was the highest in Manipur at 45.25 per cent and the lowest being 11.54 per cent in Arunachal Pradesh. Co-operative Banks showed the highest C.D ratio in Tripura (82.73 per cent) and the lowest in Mizoram (35.40 per cent). It is seen that the mobilized financial resources was not ploughed back within the region for its all-round economic development, causing low capital formation.

Agricultural Advances

The total agricultural sector advances as percent to aggregate advances by Commercial Banks, Regional Rural Banks and Co-operative Banks varies from a high of 24.50 per cent in Tripura to a low of 10.23 per cent in Assam. Bank-wise analysis reveals that Commercial Banks advanced around 22 per cent in Arunachal Pradesh, Nagaland and Tripura while it

was around 10 per cent in Assam, Meghalaya and Manipur. In case of Regional Rural Banks, it was the highest in Meghalaya (42 per cent) and lowest in Nagaland (13.90 per cent). The ratio of sector advance to aggregate advance is 43.25 per cent in Nagaland and the lowest being 7.30 per cent in Arunachal Pradesh. Thus, the low level of participation of the rural financial institutions in the agricultural sector advancing exhibited a gloomy picture in the northeastern states. The Commercial Banks have shown worst performance in this regard as compared to that of RRB's and Co-operatives. The comparative performance in agricultural sector advance for other banks is also not satisfactory. It is observed that the relative share of agricultural sector advance across the states in the region, is in the range of 48.25 per cent in Tripura to 69.81 per cent in Assam. The results thus indicate that the proportion of agricultural sector advance remained the least in the northeastern India. This matter may be thoroughly looked into.

Direct Financing to Farmers by Commercial Banks

The relative share of the total short-term direct finance during 1984-89 and 1996 across farm sizes reveals that up to 1989, the share of marginal, small and medium appeared to be more or less similar in NE India as well as the country as a whole. However, in the recent years, it is observed that the share of medium/large farms has increased than that of other groups in all the regions indicating bias in favour of higher farm sizes. This is an unhealthy sign of direct financing of short-term loan, specially in a situation where the marginal and small farmers dominate the agricultural sector. The incidence of scale bias in short-term direct financing towards large farm of the northeastern India in recent years need to be thoroughly looked into. The Commercial Banks need to provide both direct and indirect finance to farmers.

Availability of Agricultural Credit

The analysis of credit availability indicates that direct short-term credit per ha in the northeastern India is less than Rs 100 against a national average of Rs 421.50 per ha. This is a meager amount in the context of modern agricultural technology, which is basically a capital intensive activity. Under such circumstance, commercialization of agriculture through modernization without improved institutional financial backup would be a distant dream for NE states. Farm level studies on agricultural credit show that credit requirement per hectare of cropped area is substantially high being Rs 1300 in Assam as compared to credit availability. Some relevant and important observations based on farm level investigation are discussed in the next section.

Case Studies

Inadequacy of farm credit: A study conducted on marketing finance for certain important crops in Barpeta district of Assam indicates that none of the producer/seller availed institutional marketing credit as the term and condition laid down by the institutions were not favourable to them. Therefore, they obtained 40.15 per cent of the total credit from friends/ relatives and the rest (59.85 per cent) from money lender and commission agent. Although money lenders and commission agents provided marketing credit on personal security and charged a high rate of interest as compared to friends/relatives who charge no interest. Market intermediaries borrowed marketing credit from both the institutional and non-institutional sources with the share of 59.63 per cent and 40.37 per cent respectively. The analysis thus revealed that the credit supply from institutional sources is inadequate to meet the credit requirements of farm producers and the market intermediaries.

Diversion of farm credit: The study conducted in central Jorhat and North West Development Block observed that about 41.25 per cent farmers borrow production loan from institutional sources, 18.56 per cent from landlords and 17.53 per cent from friends, relatives and other sources. None of the farmers availed consumption credit to mitigate family consumption requirement. Per capita and per household annual deficit of consumption expenditure recorded at Rs 554.47 and Rs 3720.50 with respect to low and Rs 86.27 and Rs 612.54 respectively for medium income farmers. It leads to the incidence of production credit diversion to the extent of 46.04, 30.61 and 16.33 per cent respectively by low, medium and high income group farmers primarily to meet their day-to-day consumption requirement. Therefore, there is need to link consumption loan along with production loan by the institutional agencies in order to check diversion and to ensure better use-farm credit.

Repayment performance of farm borrowers: Another study conducted in Jorhat sub division of Assam estimated farmer's loan overdue to the extent of 47.70 per cent ranging from 57.21 per cent for medium, 47.77 per cent for large and 46.13 per cent for small farms borrowers. Extent of overdue varied among the financial institutions, the highest being 71.60 per cent for Punjab and Sind Bank and the lowest (13.78 per cent) in case of Federal bank. The purpose-wise analysis indicates the highest overdues (78.39 per cent) with respect to purchasing fishing equipment and the lowest (17.02 per cent) for acquiring milch cattle. The repayment performance of the small-sized borrowers was relatively better in comparison to other size groups, of which the best performance was observed in cattle loan. Certain economic, social, behavioural and administrative factors seem to influence the overdue behaviour of the farmers. Considering the repayment potential,

large and small farmers do not seem to be willful defaulters, while medium farmers who had comfortable repayment capacity are the willful defaulters. The debt equity analysis indicates that the farmers were not adequately financed in the area.

The other findings indicate a number of misidentification of IRDP beneficiaries and the gap between planned and actual amount of IRDP financing, lack of long-term capital for tea cultivation, performance of co-operative credit societies and their problems and prospects etc.

From the foregoing the discussion following constraints and strategies may be identified for effective agricultural financing programmes and thereby ensuring agriculture and rural development in the Northeastern India.

1) The policy of public interest institutional development be introduced. The lowest C.D. ratio of commercial Banks having the highest growth in the northeastern states resulting draining out of huge amount of financial resources to other developed regions be checked.

2) Direct short-term finance bias towards higher farm size must be addressed in the context of dominance of marginal and small holding in the northeastern India.

3) Lowest proportion of agricultural sector advancing by lead commercial banks with respect to their aggregate advance in comparison to all financial institutions need be examined carefully

4) Credit availability from the institutional agencies must be increased to meet farmer's production expenditure in the context of new technological development.

5) Misutilization and diversion of farm credit should be checked to prevent wastage of scarce financial resources.

6) Effective operation by institutional agencies in the rural areas could help reducing the dominance of non-institutional sources and thereby exploiting rural population.

7) Wrong identification of IRDP beneficiaries leading to diversion of scarce resources and poor implementation of development programmes is a matter of concern.

8) Time, adequacy and supervision of farm credit should be ensured to check large-scale overdues particularly in case of co-operative credit[1]

[1] Detailed tables and relevant data are with the authors

13 EMERGING SELF-HELP GROUPS– INSTRUMENT FOR PROMOTING MICRO CREDIT SYSTEM

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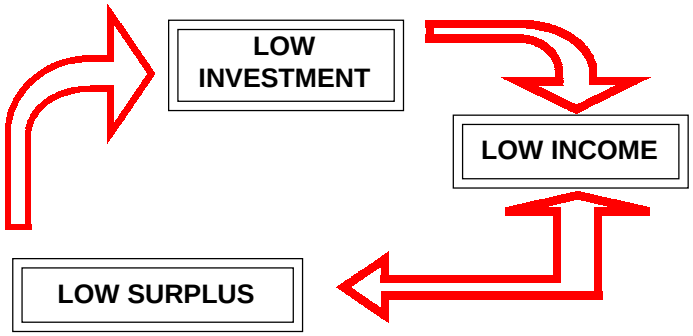
Indian Poverty Scenario

Approximately 400 million people in India living below or close to the poverty line, could be roughly translated into 75 million households out of which around 60 million are rural household. So poverty in India has predominantly a rural character. While there are several structural dimensions to the rural poverty it is generally accepted that it arises due to the lack of capital or lack of surplus. The rural poor is perpetuating poverty and is the victims of the "vicious cycle of poverty"

Vicious cycle of poverty



Poverty Alleviation Interventions

Therefore, the established policy prescription tries to break this cycle of poverty through infusion of credit. It is believed that one, two or three doses of credit infusion could break the cycle. Hence, credit is a major policy thrust for rural poverty alleviation. Three major components are common in all institutional rural credit system, which remained constant since the 1950s.

The Rural Credit Programme has three important components

- ❖ Institutionalize credit
- ❖ Enlarge coverage
- ❖ Provide timely and adequate finance

Increased involvement of banks in rural credit in post nationalization era is essentially viewed credit as an integral part of the socio-economic developmental efforts in the rural area and the network of commercial banks were used especially to enlarge coverage. During the period, banking network has reached a spectacular expansion in the rural India. However, the formal financial systems are not been able to benefit more than half of indebted rural households, despite having a vast network of 125000 commercial, co-operative, rural banks and non-banking financial institutions.

On the institutional front, shortly after independence, the policy makers recognized the criticality of people's participation in the development process. To ensure the peoples' participation, the Government intensified banking activities by opening large number of co-operatives in rural areas to provide credit inputs and marketing facilities to farmers. The other attempt made by the Government was setting up and strengthening of Panchayat Raj institutions through 73rd and 74th amendment of the Indian Constitution. However, many of these institutions are being dogged by financial non-viability. Local level politics inconvenienced with bureaucracy saw these institutions relegated to power centers of the local elite. The bureaucratic interference gave rise to corruption; partisan interests and consequently, people were kept away from these people's organizations.

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- Credit dispensing bodies, in this case the banks did not have any role in identification of activities and borrowers. Partisan local political interests had dominated the process. This patronage led to emergence of middlemen at all levels and corruption.

- In this permissive atmosphere, it is no wonder that repayment ethics goes for a toss.
- By the time joint identification committees were set up, the bankers lost interest in the programme. With the introduction of prudential norms of asset classification since the early 1990s, bankers started citing the default as the major reasons of non-adherence to implementation target of the programme (it is a different matter that a recent study published in the Journal of Rural Development, April-June 1999, has put a very insignificant correlation between poor recovery performance of banks and their exposure IRDP and weaker section loans).
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Even after considering all the small loans of the banking system, the situation is still in the nascent stage of access to credit by the people. Small loans account for nearly 93.6 per cent (0.56 million accounts in 1994) of total number of loans and 18 per cent of the total amount. Of these, 80.5 per cent of the total accounts loan is loan outstanding less than Rs 7500. Purpose wise, small agricultural loans accounted for 45.8 per cent, tiny manufacturing 20.2 per cent. By 1998, the total number of small borrowers is 50 million households. The micro loans cover 40 million households in 2000 (assuming percentage of micro loans below 7500 remaining constant). The remaining 35 million households are perhaps meeting their credit needs from informal sector-landlords, moneylenders, pawnbrokers, traders, relatives etc. Apart from a large unreached people, it implies a process failure and as a result the institutions failed to address issues on distributional social justice.

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2) The institutional design should be participatory in nature

In this context, the grassroot organization plays crucial role. The governmental and institutional policies need to be geared towards providing

a conducive environment to the poor to develop their own organizations. The growing realization during the decade of 1990s has resulted in growth of people's organization of various types. If one judges them by the reach and proximity to people, Self-help Groups (SHGs) could be termed as the most prominent among them. Both Government and Financial Institutions are now operating through Non-governmental Organization (NGOs) to develop SHGs. However, even before institutional patronage, NGOs had been promoting this grassroot organization as a platform for social interventions.

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The uniqueness of these groups lies in the fact that to a large extent they are self-supporting self-governing organizations free from bureaucratization and politicization. The process empowers the poor and enables them to control direction of own development by identifying their felt needs.

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The SHG movement added a very significant dimension as it was to be linked with the micro finance. Micro Finance (MF) has now been widely accepted as an effective intervention strategy for poverty alleviation, which is easily accessible to the poor, reduces transaction cost and where repayments are designed to fit cash flow for the borrowers. Micro finance includes thrift, credit and other financial services and products of very small amount.

There may be various medium of micro finance; however, the most prominent among them has been the medium of SHGs. In 1992, national bank (NABARD) gave a fillip to the movement when it started the SHG-Bank linkage programme. This was the first major attempt to link the mainstream financial institutions with the informal groups, thereby, linking them with the market. Till then, the role of financial markets in poverty alleviation and its implications of developing an NGO constituency in financial service landscape had remained a grossly under-explored area in policy research.

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It also aimed at the re-assertion of the basic principle that the magic of market succeeds where the governmental intervention failed. This belief is based on the certain structural advantages of the mF in the SHG mode:

- Financing becomes cost effective According to a study conducted by NABARD, there has been a 40 per cent reduction in transaction cost for banks due to externalizing banks' responsibilities in identification of clients, assessment of risk profile, loan monitoring and recovery
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As stated earlier, 75 million households is requiring micro finance; 60 million in rural India and 15 million urban households. The annual credit usage can be put around Rs 500000 million assuming Rs 6000 as average rural and Rs 9000 as average urban household usage. Please note that this is usage and not demand.

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Though there is still large unmet demand, the growth of SHGs has been phenomenal in the recent years. However, the reach of SHGs/MFIs are not uniform across the country. While south India strides ahead, North Eastern India is still at a very nascent stage of mF development. As against a national figure of 150000 SHGs and Rs 1500 million NABARD's bank linkage, the share of Assam has been140 SHGs dealing a volume of credit of Rs 1.56 million.

The voluntary sector intervention of the Rashtriya Grameen Vikas Nidhi (RGVN) is the largest voluntary sector intervention in the Northeast in Credit and Savings Programme. Following broadly the Grameen model, this programme today has around 1600 groups with over 2700 members. The total amount of cumulative savings is Rs 12.87 million and loan disbursed has been Rs 77.28 million since the inception of the programme in October 1995. So far, RGVN's operation is concentrated in undivided Goalpara and Kamrup districts of Assam. Very soon it will be spun-off as a section 25 company.

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Weaknesses of the SHG

There are certain inherent weaknesses of the SHG mode of intervention. Such an intervention is being marketed as a 'tool kit' for poverty alleviation and tends to ignore larger structural bottlenecks like inadequate agricultural infrastructure-irrigation, roads and highly in egalitarian distribution of land.

Given the preoccupation with regularity of repayment, the credit programme shows a clear bias towards activities like petty trading (Due to daily cash flows), which do not result in significant value-addition to promote capital formation.

Solidarity is an expensive input for financial services production as the costs of group formation and interaction outweigh the benefits of high repayment with group control.

The MFIs are generously assisted by grants and cheap credit. SHARE had a grant component to the tune of 69 per cent of their total fund in 1998. It is thus anticipated that to be effective and productive, the promotion of SHG for ensured assess credit is necessary.

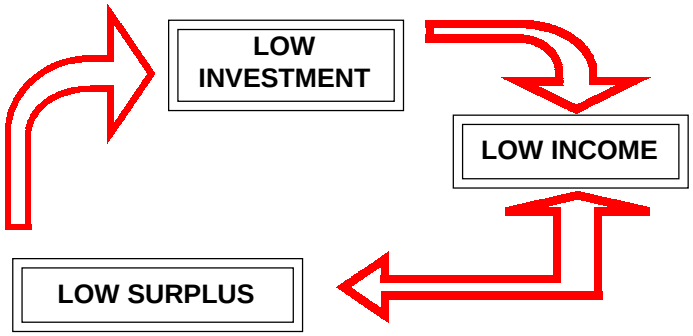
13 EMERGING SELF-HELP GROUPS– INSTRUMENT FOR PROMOTING MICRO CREDIT SYSTEM

Dilip Sarma
Head, Resource Unit, Rashtriya Gramin Vikas Nigam
Guwahati, Assam

Indian Poverty Scenario

Approximately 400 million people in India living below or close to the poverty line, could be roughly translated into 75 million households out of which around 60 million are rural household. So poverty in India has predominantly a rural character. While there are several structural dimensions to the rural poverty it is generally accepted that it arises due to the lack of capital or lack of surplus. The rural poor is perpetuating poverty and is the victims of the "vicious cycle of poverty"

Vicious cycle of poverty



Poverty Alleviation Interventions

Therefore, the established policy prescription tries to break this cycle of poverty through infusion of credit. It is believed that one, two or three doses of credit infusion could break the cycle. Hence, credit is a major policy thrust for rural poverty alleviation. Three major components are common in all institutional rural credit system, which remained constant since the 1950s.

The Rural Credit Programme has three important components

- ❖ Institutionalize credit
- ❖ Enlarge coverage
- ❖ Provide timely and adequate finance

Increased involvement of banks in rural credit in post nationalization era is essentially viewed credit as an integral part of the socio-economic developmental efforts in the rural area and the network of commercial banks were used especially to enlarge coverage. During the period, banking network has reached a spectacular expansion in the rural India. However, the formal financial systems are not been able to benefit more than half of indebted rural households, despite having a vast network of 125000 commercial, co-operative, rural banks and non-banking financial institutions.

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14 SHIFTING CULTIVATION PRACTICES IN MANIPUR

N Ram Singh
Agricultural Economics
Central Agricultural University, Imphal

Agricultural Setting

The State of Manipur is a small landlocked, hilly and mountainous state within the northeastern India. It has 22327 sq. km of area, which constitutes 0.7 per cent of the total land surface of India. The state has a small valley area of about 1843 sq. km, which is only 8 per cent of the total area of the state. The remaining 92 per cent is hills and mountains. The state has a total population of 1837149 in 1991. Majority of the population as much as 67 per cent of the states population is concentrated in the small valley area.

Agriculture is the single largest source of livelihood of about 70 per cent of the population and it is also the mainstay of the state's economy. The state can be divided into two physiographic zones-valley and hills. The valley has an average altitude of 872 meters above MSL and the climate is subtropical and warm in the summer season. This part is the "rice bowl" of the state. The hill areas are under temperate subtropical climate at the average altitude of 3000 metres above MSL. The state had distinct winter, warm humid and rainy seasons. The average rainfall is 1482 mm with heavy precipitation during the months of June, July and August. There is post and pre-monsoon shower during October and February. The state is very small but the agro-climatic conditions are different from one place to another because of the different elevations. The district-wise agro-climatic situations, area and production of rice in Manipur is given in Table 2. The cultivation of rice is the major agricultural activity in Manipur and the main food for the people. The agro-climatic conditions are also most suitable for the cultivation of rice by traditional method of farming. Rice also contributes a major share of household income to Manipur.

Out of the total hill area of 2.05 lakh ha, only 0.64 lakh ha are cultivated area. It is approximately 3 per cent of the total land area. Whereas in the valley, out of the total land area of 1.84 lakh ha, 0.87 lakh ha are under rice cultivation. It is more than 47 per cent of the total area of the valley.

Shortage of rice of about 1.5 lakh tonnes, every year is the major problem of Manipur. The deficiency of rice is becoming more and more acute in recent years because of the rising population on the fixed area of cultivable land. The following Table shows the estimated population and the required quantity of rice and area of land for next decade.

Table 1: Projected population and food demand in 2010-11

Year	Estimated population (In lakh)	Requirement of rice (lakh tonnes)	Required area of land (lakh ha.)
2000-01	22.9	4.48	2.4
2001-02	23.5	4.93	2.46
2002-03	24.0	5.04	2.50
2003-04	24.7	5.18	2.59
2004-05	25.2	5.29	2.64
2005-06	25.8	5.41	2.70
2006-07	26.5	5.56	2.78
2007-08	27.0	5.67	2.84
2008-09	27.7	5.81	2.90
2009-10	28.4	5.96	2.98
2010-11	29.0	6.09	3.00

To fulfill the required quantity of rice of 6.09 lakh tonnes in next 10 years, the state needs to expand the cultivated area under crop or to increase the productivity of rice or promoting intensified agricultural system by multiple cropping system. Most of the permanent land for agriculture is at the valley portion of the hill districts. The area under permanent agriculture has increased at about 36.0 thousand ha in 1993 from 32.26 thousand ha in 1990. There is also change of the area of shifting cultivation in Manipur. During the period, the area of shifting cultivation is also increased to 24.45 thousand from 23.81 thousand ha. The structure and nature of cultivation practices in Manipur could be visualised from the table 2.

The area of shifting cultivation is more than the area under permanent cultivation in three out of five districts except Tamenglong and Chandel districts. There is a very vast area suitable for permanent agriculture at the valleys of Barak river system of Tamenglong district.

Shifting cultivation or *Jhum* (*Paamlou* in Manipuri language) is widely practised in Tamenglong district among others. The vast area of bamboo growing zone of the district suitable for low-cost shifting cultivation. Bamboo land could be used for shifting cultivation. After 5 to 6 years, the bamboo forest is again developed and the land is reutilized for *jhum* cultivation. As

Table 2: Districtwise distribution of area under permanent and shifting cultivation

Sl. No.	Name of district	Type of cultivation	1990-91	1991-92	1992-93	Triennium ending average
1	Senapati	Permanent	19.32	19.20	17.24	18.59
		Shifting	1.78	2.73	0.97	1.83
		Total	21.10	21.93	18.21	20.42
2	Tamenglong	Permanent	1.61	1.72	2.83	2.05
		Shifting	7.40	8.26	7.07	7.58
		Total	9.01	9.98	9.90	9.63
3	Churachandpur	Permanent	2.73	4.32	4.69	3.91
		Shifting	5.74	4.90	5.63	5.42
		Total	8.47	9.22	10.32	9.33
4	Chandel	Permanent	1.99	4.05	1.54	2.53
		Shifting	3.52	3.22	6.63	4.46
		Total	5.51	7.27	8.17	6.99
5	Ukhrul	Permanent	6.61	7.83	12.26	8.90
		Shifting	5.37	5.18	4.94	5.16
		Total	11.98	13.01	17.20	14.06
6.	Total hill districts	Permanent	32.26	37.12	38.56	35.98
		Shifting	23.81	24.29	25.24	24.45
		Total	56.07	61.41	63.80	60.43

Source: Crop Estimation Survey 1995 Deptt. Of Economics and Statistics, Government of Manipur.

there is no serious problem of land for agriculture, the poor farmers are not taking care for environmental problems and sustainable agriculture. The improved method of shifting cultivation is developed by the *Tribals of Machi* Block of Chandel district in Manipur, because of the acute problem for acquiring agricultural land and inadequate facility for terracing. As per the customary law, the village boundaries of the tribal areas are strictly controlled by the village authorities, hence, there is no scope for expanding shifting cultivation across the individual village boundaries. Particularly, the Maring tribes of the district emphasized on the conservation and protection of their inherited land for a sustainable food production and income generation. The farm developed by the progressive Jhumias at Karongthel village of Maring tribe shows that there is a possibility for adoption of environmental-friendly shifting cultivation which is adopted in the village.

Improved Machi model of shifting cultivation

It consists of the following components:

A) Selection of site for shifting cultivation:

1) The old farm used by their own forefathers of the family
2) The mild slope with proper sunshine
3) The soil which could be conserved and controled at the depth of 4” to 6”
4) Area about 1 ha and not less than 2 acres

B) Preparation of land for shifting cultivation and the cost component:

	Items	Required mandays	Cost (in rs.)
1	Forest cutting	25@ Rs 50 per md	25 x 50 = 1250
2	Burning and clearance of forest growth	10@ Rs 50 per md	10 x 50 = 500
3	Formation of drains at the gap of 30 to 35ft.of the slopes of 2ft. wide	25@ Rs 50 per md	25 x 50 = 1250
4	Formation of soil guard with the use of woods and bamboos (3 rows across the slope)	15 @ Rs 50 per md	15 x 50 = 750
5	Plantation of bamboo, mango, banana, pineapple, papaya, tree beans, citrus fruits, etc.	5 @ Rs 50 per md	5 x 50 = 250
6	Construction of farm-house and farmstead	6 @ Rs 50 per md	6 x 50 = 300
	Total	86 @ Rs 50 per md	86 x 50 = 4300

However, most of the works are done by family members on traditional system of collective action.

Cost of cultivation (Improved *Jhum* in 1999 prices)

	Items	Period	Man days	Value in rupees (rs)
1	Completion of field preparation	Dec./Jan	86	@Rs 50/Md 86x50=4300.00
2	Dibbling planting and wowing (rice, maize, pulses, oilseed, spices, tobacco, medicinal plants and herbs, pumpkins, brinjals, oilseeds and vegetables, etc.)	Feb/March	40	40x50=2000.00
3	Weeding	June/ July	40	40x50=2000.00
4	Harvesting	Sept./ Oct.	30	30x50=1500.00
5	Threshing	Sept./ Oct.	30	30x50=1500.00
6	Inputs: seeds: Rice 150 kg @ Rs10/kg Maize 10 kg @ Rs12/kg Others of the value of Rs 300/0			 1500.00 120.00 300.00
7	Misc. expenses			1500.00
	Total cost: Rs 14720.00			

Income flow from the improved method of shifting cultivation

(First year - 1999 prices)

	Crop	Yield (kg)	Value in rupees
1	Rice	1600 @ Rs 6/kg	9600.00
2	Pulses	200 @ Rs 10/kg	2000.00
3	Vegetables	300 @ Rs 4/kg	1200.00
4	Spices – chilly ginger and turmeric	5 @ Rs 20/kg 100 @ Rs 6/kg	100.00 600.00
5	Tapioca, yam, sweet, potato	40 @ Rs 6/kg	240.00
6	Oilseeds Mustard and groundnut etc.	10 @ Rs 10/kg	100.00
7	Maize, millets etc.	100@ Rs 7/kg	700.00
8	Medicinal plants and herbal spices (local)		300.00
9	Trees and fuelwoods	200 monds @ Rs15/m	3000.00
	Total	**17840.00**	

Net Farm Income for the first year = Gross Income – Total Costs = Rs 17840 – Rs 14720 = Rs 3120.00

Cost and income of 2nd year

In the second year of the shifting cultivation, there is no cost of land preparation except minor repairing and soil management. The cost of cultivation in the second year is:

Costs of shifting cultivation

	Items	Man days	Value in rupees
1	Repairing of drain and soil management	20 @ Rs.50 per man days	1000.00
2	Dibbling, planting and sowing of rice, maize, pulses, oilseed, spices, tobacco, medicinal plants, vegetables	45 @ Rs.50 per man days	2250.00
3	Weeding	@ Rs.50 per man days	2000.00
4	Harvesting	@ Rs.50 per man days	2000.00
5	Threshing	@ Rs.50 per man days	2500.00
6	Inputs: Seeds		
	Rice 150kg. @ Rs.10 per kg.		1500.00
	Maize 10kg. @ Rs.12 per kg.		120.00
	Others of Rs.400.00		400.00
7	Misc. expenses		1000.00
	Total cost		12770.00

Income

There is no change in the productivity of different crops in the second year and there is no income from trees and fuelwood to the extent of Rs 3000.00 in the 2nd year. The total income from different crops excluding Rs 3000.00 during 2nd year is estimated at Rs 15840.00. The net income in the second year = Rs 15840-12770 = Rs 3070.00.

Costs and Income of 3rd year of the shifting cultivation

There is a decrease of about 15 per cent of the yield of rice in the 3rd year. However, there is more income from pineapple, papaya, banana, sugarcane, vegetables, groundnut, cotton and tobacco, etc. So, there is sustainable income from the farm not less than the income during the previous year. The same productivity and income is obtained during the 4th and 5th, 6th years at the same operational cost.

From 7th year onwards there is more income from tree bean harvesting about 1000 kg @ Rs 4 per kg = Rs.4000.00.

Hatkora pineapple and citrus fruits =1000kg @ Rs 45 per kg	= Rs 4000.00
Grasses for house roof	= Rs 500.00
Bamboos	= Rs 500.00
Banana	= Rs 400.00
Vegetables, spices, pulses and medicinal plants	= Rs 400.00
	= Rs 6300.00

From 7th year onwards there is regular income from the old *Jhum*. The maintenance cost of the old *jhum* is about 25 mandays or Rs 1250.00 per annum. The *Jhum* system consisting of fruits and vegetables along with natural forest growth is managed by the family without disturbing the soil for about 6 to 8 years. Then the old *jhum* is changed into a perfect natural forest alongwith horticultural crops. After about 8 years the old *jhum* is changed into a new rice farm. There is no change of land structure but there is change of crop and natural forest plants. During the period of fallow special attention is given to the management of horticultural crops and animal husbandry like poultry, pig rearing etc. *Jhum* or shifting cultivation is the oldest method of farming of the people of Manipur since the prehistoric period. The method is still continuing in spite of the government regulations in the hill areas because of the following facts:

1) There is no ownership right of land for a family farm
2) It is an ecological friendly system of farming
3) There is no risks and uncertainty of the farming
4) There is full employment of the family members
5) High possibility of diversified farming
6) It is an occupation with a blend of culture and romance
7) It supplies feed and fodders for wild, semi-domestic and domestic animals
8) It enriches the fertility of the foothill areas
9) It preserves medicinal plants, herbal spices and indigenous plants, etc.
10) It is a gainful occupation with the use of the low-cost traditional technology of the poor people
11) It is harmless to the quality of soils and water resources of the hills
12) It preserves the traditional tribal institution as indigenous education technologies and other rural activities