

**REPORT OF
THE WORKING GROUP ON
AGRICULTURAL DEVELOPMENT IN
EASTERN & NORTH EASTERN INDIA
FOR
THE FORMULATION OF THE TENTH
FIVE YEAR PLAN**



**GOVERNMENT OF INDIA
PLANNING COMMISSION
AUGUST, 2001**

CONTENTS

<u>S.No.</u>	<u>Subject</u>	<u>Page No.</u>
	Executive Summary	i–viii
1.	Introduction	1-3
2.	An Overview	4-38
3.	Problems and Constraints	39-62
4.	Vision and Approach to Development	63-90
5.	Recommended Action Points	91-113
6.	Appendices	114-128

**REPORT OF THE
WORKING GROUP ON
“AGRICULTURAL DEVELOPMENT”
IN
EASTERN & NORTH EASTERN INDIA”**

**FOR THE
FORMULATION OF THE 10TH FIVE YEAR PLAN
(2002-07)**

Chairman: Shri Bhaskar Barua
**Former Secretary, Government of India,
Department of Agriculture & Cooperation
Ministry of Agriculture, New Delhi.**

Member Secretary: Shri Govindan Nair
**Joint Secretary (Policy & Planning)
Department of Agriculture & Cooperation
Ministry of Agriculture, New Delhi.**

**CONSTITUTED
BY**

**PLANNING COMMISSION
GOVERNMENT OF INDIA
(August, 2001)**

EXECUTIVE SUMMARY

1. While the rate of growth of Indian agriculture has been slackening, the pace of agricultural growth in the Eastern and North Eastern regions has been slower than in the rest of the country. The Green Revolution was largely limited to the North Western parts of the country and, for a variety of reasons, has not found expression in the Eastern and North Eastern States.

2. In terms of development indices, the Eastern and North Eastern States are among the most backward in the country. As the aim of our planning process is to improve the quality of lives of all citizens, the inhabitants of the Eastern and North Eastern regions merit foremost attention. In view of the predominant status of agriculture in the region, a break-through in the human development graph can be achieved only by addressing the key issues of agriculture and its allied sectors.

3. In the Tenth Plan, therefore, a paradigm shift is needed in developmental planning so as to focus centrally on agricultural development in the Eastern and North Eastern regions. In other words, the Eastern and North Eastern regions should receive special attention in the Tenth Plan, with agriculture and its allied sectors taking the central position in developmental planning, and the welfare and well-being of the farmer must lie at the core of strategies and programmes.

4. As the region is marked by various deficits arising out of historical and other reasons, a special effort is required to reverse the trend towards alienation and distancing of the people from the main-stream. To this end, innovative participative planning, sensitive implementation and novel delivery systems are needed.

5. The Eastern and North Eastern regions hold enormous potential for development of agriculture, horticulture, animal husbandry and fisheries. The

gaps between actual and potential yields are such that huge production increases can be achieved in the region, and for the country as a whole, simply by using available and accessible technologies.

6. The vision for agricultural development in Eastern and North Eastern India should comprise of the following elements:-

6.1 Providing multiple livelihood opportunities: The first priority in agricultural strategies and programmes should be income enhancement of the farmer through provision of multiple livelihood opportunities by increasing non-agricultural employment from utilization of local strengths and resources.

6.2 Sustainable agricultural development through Farming Systems Approach: Precision farming methods must be adopted to attain optimum income and yield per drop of water and per unit of land and time, through an area specific farming systems approach, combining crop and animal husbandry, horticulture and agro-forestry.

6.3 Efficient National Resources Management: Regional imbalances in agricultural development, being largely based on availability of assured irrigation, can be corrected through conservation and enhancement of soil and water resources through an integrated package aimed at environmental and economic sustainability.

6.4 Strengthening capital formation in the Agriculture Sector: The sector is capital starved. Investment in the agriculture sector, must be driven by the public sector, particularly in building essential infrastructure. Private sector investments will follow, given conducive environment.

6.5 Converting “backwardness” to comparative advantage: Agriculture in the North Eastern region, and to an extent the Eastern region too, is characterized by

perceived backwardness in terms of low input use etc. However, significant gains may accrue from the growing demand for organic products in developed market. Similarly, the extensive international border in the North East provides remarkable opportunities for border trade and export.

6.6 Stimulating new employment opportunities: The challenge in the coming decade will be to make farming and other rural occupations intellectually stimulating and economically rewarded so that educated youth may be attracted and retained in rural areas. The North Eastern region, with its high literacy level, offers significant opportunities for non-traditional occupations.

6.7 Harnessing the gains of Frontier Technologies: Innovative extension delivery systems should be evolved to purvey the knowledge revolution to the farmers so as to promote higher productivity and sustainable livelihoods.

6.8 Decentralisation and Micro-Planning: For optimum delivery of services and programmes, a decentralized participatory system is required, based on micro-planning, local needs assessment, community empowerment and an enlarged role for women.

6.9 Promoting Marketing and Value Addition: This major lacuna in the Eastern and North Eastern region needs to be filled by developing modern marketing systems, based on post-harvest management, handling, grading, packing, processing, storage and transport, with adequate credit support and market intelligence.

7. Uniform policy prescriptions are impractical. The basis of policy formulation should be “think, plan and act locally, and support nationally”. The approach to agricultural development in the Eastern and North Eastern regions, may be based on the following components:

7.1 Eco-Regional Technology Missions: This is based on the blending of traditional wisdom and practices with frontier technologies so as to promote employment generation, conservation and local initiative. A holistic approach should be adopted to integrate production and post-harvest technologies, on-farm and off-farm employment, and to achieve vertical and horizontal linkage of different activities.

7.2 Rice – based Farming Systems: As rice is the main crop in Eastern States as well as valley areas of the North East, rice based farming systems involving pisci-culture and rearing of animals/small ruminants, poultry, piggery and goat may be introduced in the form of an integrated farming system.

7.3 Utilisation of rice – fallow areas: As the region is largely unirrigated, the single crop that is taken, usually rice, is followed by fallow. However, the residual moisture in the soil being high, it is possible to take a second crop in Rabi of oilseeds, pulses or vegetables, with the application of appropriate practices.

7.4 Location-specific Diversified Farming Systems: Large areas of Eastern India, which are prone to waterlogging, can, inter alia, be put under profitable aquatic farming systems for Makhana, Singhara, Swamp-taro, etc. as well as fisheries.

7.5 On-Farm Water Management: Exploitation of the plentiful ground water resources of the Eastern region is very meager. A scheme to encourage use of groundwater, in combination with other practices, will increase cropping intensity and lead to remarkable productivity gains.

7.6 Sustainable Agro-Forestry Systems: The North Eastern region as well as parts of the Eastern region can be used profitably for agro-forestry, given good quality planting material, extension support, micro-credit and post harvest linkages.

7.7 Organic farming: The low input intensity of the region gives it a natural advantage in production of organic food, bio-products, etc. The region can be promoted as a centre for organically produced eco-friendly goods.

7.8 Bio-villages: These will provide opportunities for production and marketing of organic products, health food, eco- and bio- goods, herbal medicine, etc. through an integrated strategy for sustainable and equitable utilization of its natural resources and bio-diversity.

7.9 Eco-friendly 'jhuming': The traditional practice of 'jhuming' in the North East can be made less destructive through an appropriate balance of conservation and commercialization, traditional wisdom and modern techniques.

7.10 Special thrust on fruit and vegetables: The North Eastern States, as well as the Eastern region, can become a key center for production of a variety of fruit and vegetables. The Technology Mission for Integrated Development of Horticulture in the North Eastern region may be strengthened to achieve all the required linkages, including credit, in order to make horticulture the basis of economic growth of the region. Synergy between the activities of various agencies involved in this sector needs special attention.

7.11 Development of floriculture: The North Eastern region has the potential to emerge as the major supplier of floriculture products, especially orchids and cut flowers. The potential needs to be tapped by bringing together the efforts of various agencies and market development.

7.12 Strategy for medicinal and aromatic plants: Mission mode approach needs to be adopted to develop this sector covering all linkages from research and development of planting material, cultivation, post-harvest technology, processing and manufacturing, patenting and marketing. Given the unique

advantages of the Eastern and North Eastern Regions, this can be an area of high trajectory growth.

7.13 Development of animal husbandry: Livestock and dairy development have received little attention in the Eastern and North Eastern regions. The opportunity gap can, with a little effort, be filled to the great benefit of local farmers. An integrated programme is required for promotion of animal husbandry related occupations in the context of the farming systems approach, covering all linkages from animal breeding and animal health to procurement of produce, processing, transportation and marketing. Establishment of a Livestock Development Agency/Corporation may be considered.

7.14 Potential for fisheries: Keeping in view the vast and varied aquatic resources available in the region for fish production, this area can yield substantial returns. An integrated approach will significantly enhance rural income and livelihood security.

7.15 Post-harvest management, storage and marketing: These are critical areas, in which the weaknesses of the region are highlighted. Primary attention needs to be focused on creating the necessary infrastructure, providing incentives for entrepreneurs, dismantling redundant controls and restrictions, making available credit and empowering producers.

7.16 Enhancing availability of institutional credit: This is a critical weakness in the Eastern and North Eastern Region which is compounded by the weak cooperative credit structure and inactive commercial banks and RRBs. The issue of increasing the availability of production and investment credit needs to be urgently addressed in the absence of which many of the initiatives proposed for the region would be still-born. If required an Agricultural and Rural Development Corporation may be established for the region. Micro-credit,

promotion of Self-Help Groups and provision of share capital assistance should be stepped up.

7.17 Synergising the efforts of Governmental/Non-Governmental Agencies: In view of the resource potential of region, Commodity Organisations, Export Promotion Councils, Research Institutes, NGOs, as well as Private Sector units involved in building infrastructure, processing, marketing and exports need to synergise their activities and work to a coordinated plan of action. The North Eastern Council may play a nodal role in this regard.

7.18 Attracting and retaining youth in farming: New technologies offer stimulating and attractive areas for self-employment. Farming Graduates may be encouraged to take up consultancy and guidance services in rural areas in connection with integrated precision farming systems. By encouraging entrepreneurship in the agricultural sector, not only will the rural economy be given a boost, but various socio-cultural problems may be avoided.

7.19 Novel systems of extension delivery: The transfer of knowledge and innovation in the shortest time possible to users at the field level is essential for success of integrated intensive farming systems. Traditional extension systems need to be thoroughly revamped. Government may play a catalytic and facilitative role in promoting demand-driven private sector delivery mechanisms and consultancy services.

7.20 Export thrust: The region offers enormous potential for exports. Besides the extensive border trade possibilities in the North Eastern region, the export basket of the region is also varied and full of opportunities. By building up marketing information and export orientation of production processes, promoting quality production and product diversification, and adopting targeted production and marketing strategies, huge gains may be obtained.

8. The WTO regime and the opening up of Indian agriculture have thrown up a range of opportunities for Indian agriculture while making it imperative to enhance the efficiency and competitiveness of agricultural operations. As seen above, the Eastern and North Eastern region has huge potential for not only increasing productivity and efficiency but also for capitalizing on the opportunities offered by the new trade regime.

1. INTRODUCTION

1.1 Indian Agriculture has made remarkable progress since Independence. In taking the annual production of foodgrains from 50 million tonnes in 1950 to 209 million tonnes at the turn of the century, the country has achieved self-sufficiency in food and overcome the chronic food shortages of the past. The pattern of growth of agriculture has, however, brought in its wake uneven development across regions and crops, as also differences across sections of the farming community. Meanwhile, even as foodgrains stocks of the country have grown to a mammoth 60 million tonnes, the number of food insecure persons hovers around 300 million. In terms of poverty and backwardness, the Eastern and North Eastern regions of the country occupy a category of their own. As the S.P. Shukla Commission Report pointed out in the context of the North East, the region is confronted by four deficits: a basic needs deficit, an infrastructural deficit, a resource deficit, and, most important, a two way deficit of understanding with the rest of the country which compounds the others. The Eastern region too faces at least the first three of these deficits.

1.2 The deficits in Eastern and North Eastern India have existed for far too long; allowing them to persist any longer would be perilous to the country as a whole. The aim of our planning process is to improve the quality of life of all citizens; safeguarding the livelihood security of the rural and urban poor should be the bottom line of developmental planning. While, in view of the relative backwardness of the Eastern and North Eastern States, this region should merit foremost attention in the planning process, this unfortunately has not been the case. Looking at the predominance of agriculture as the source of livelihood in the region, a breakthrough in the human development graph of the region can be achieved only by addressing the key issues of the agriculture and allied sectors.

1.3 It is, therefore, essential that the first Plan of the new millennium should bring a paradigm shift in developmental planning in the country. The Eastern and North Eastern regions have largely been by-passed in the planning process in the last several years, the results of which are increasingly explicit. The Working Group, therefore, strongly feels that the Eastern and North Eastern region should form the focus of the Tenth Plan, with agriculture and its allied sectors taking the center stage of developmental planning, and the welfare and well-being of the farmer lying at the core of strategies and programmes.

1.4 The planning process, the Working Group feels, requires considerable re-tooling in the context of gained experience as well as emerging needs and realities. In the context of the North East, in particular, planning should 'with' rather than 'for' the region. In place of readymade prescriptions applicable across States and regions, area-specific and need-based interventions should be formulated on a foundation of participative micro planning. Decentralisation, delegation and empowerment of rural communities, accompanied by removal of redundant restrictions and controls, should form the core of the revamped planning process.

1.5 The huge potential of the Eastern and North Eastern regions in the sphere of agriculture, horticulture, animal husbandry and fisheries is contrasted by the low levels of productivity and entrepreneurship. The time has come to fill the yield gaps and to capitalize on the opportunities offered by the region. In the context of globalization and opening up of the domestic agriculture sector to competition from outside, the highest priority must be accorded to exploiting available potential in the country and enhancing competitiveness. In this context the Eastern and North Eastern regions provide possibly the widest and most lucrative prospects.

1.6 Planning for agriculture and its allied sectors in Eastern and North Eastern India should, therefore, be based on a holistic strategy to create a

conducive environment for the genius of the local inhabitants to avail of livelihood opportunities to significantly raise their quality of life, by making available the infrastructure and linkages necessary for higher economic productivity and sustainable agricultural development. The crying need is to raise the level of investment in the region, both in terms of hardware and software. Public investment will have to show the way, but simultaneously every effort is needed for providing the conditions to attract private investment to the region and to promote entrepreneurship.

1.7 The Working Group has had four meetings, including one at Shillong. The Group has interacted with representatives of Governments as well as with specialized agencies. Sub-Groups were created in the context of Agriculture, Horticulture, Natural Resource Management and Animal Husbandry. The Report of the Working Group has been prepared on the basis of inputs from the Sub-Groups and discussions with concerned persons.

1.8 The Report comprises of a broad overview of the existing scenario in the Eastern and North Eastern region (Chapter 2). Chapter 3 summarizes the problems and constraints confronting agricultural development in the region. A vision and approach to development of the region is outlined in Chapter 4, which comprises the essence of the Working Group deliberations. Action points that emerge from the discussions are listed in Chapter 5.

1.9 Although the Eastern and North Eastern States bear remarkable similarity in the general developmental context, the region is also marked by diverse specificities. Uniform solutions are obviously not realistic, and the action points recommended by the Working Group will have to be selectively applied. The Working Group would, therefore, suggest that the vision and approach outlined by the Group should form the basis of planning for the region, while the recommended action points may assist in fleshing out the details.

2. AN OVERVIEW

2.1.1 Till the 'fifties, the Eastern Region was reputedly the most prosperous region in the country, maintaining a lead over the other regions with highest food grain yield of 644 kg/ha as against 608, 554 and 390 kg/ha in northern, southern and western regions, respectively. However, it lost its leading position thereafter, particularly with the advent of the Green Revolution, which ushered in the 'western' model based on large scale adoption of HYV seeds, chemical fertilizers and supplemental irrigation along with plant protection measures. This model, most successful in North Western India, has not been widely replicated in the Eastern region because of a variety of constraints rooted to socio-economic features, fragmented and smaller land holdings as well as institutional, organizational, technological and developmental inadequacies.

The Eastern Region comprising of Eastern UP (85,844 sq km), Bihar including Jharkhand(1,73,877 sq km), West Bengal (88,752 sq km), Assam (78,438 sq km), Orissa (1,55,707 sq km), and Chhattisgarh(1,44,422 sq km) occupies about 28% of the country's geographical area with food grain production of 58 million tonnes(34.6% of the total), is inhabited by about 35% of the country's population. The region has 1.24 times higher population density than the national average (318/sq.km against 257/sq km national average: 1991 census).

Agricultural development is much below its potential in this region, with the result that employment in the agriculture sector is limited and a large proportion of the population still remains below the poverty line and suffers from malnutrition. For example, Bihar possessed about 3% of the total cultivated area of the country and 8% of the country's population, and produced about 6.9%(14.56 M tonnes) of the total food grains in 1999-2000. The average yield of food grains in the state was 1620 kg/ha as against the national average of 1697 kg/ha. The yield of rice in Bihar was 15.40 q/ha as against national average of

19.90 q/ha. Similarly, the yield of wheat was 20.61 q/ha as against the national average of 27.55 q/ha.

2.1.2 The North Eastern Region of India comprising of the states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura has a total geographical area of 18.4 million sq. km and a population of 9.6 million representing 5.6% and 1.3% of the total area and population of the country, produces a very meagre proportion of food grains (1.5%). The North-Eastern region falls under the high rainfall zone and the climate ranges from sub-tropical to alpine. The region is characterized by difficult terrain, wide variations in slopes and altitudes, land tenure systems and indigenous cultivation practices. Although cereals dominate the rainfed hill ecosystem, dependence on livestock and horticulture as an alternative source of income is significant.

2.1.3 The Eastern and North Eastern region can be divided into three distinct physiographical entities:

- Plains of eastern UP, Bihar, Jharkhand, West Bengal, Assam, Tripura and Manipur;
- Hilly, plateau and foothill regions in eastern UP, Bihar, Jharkhand, West Bengal, Orissa, Chatisgarh, Assam, Arunachal Pradesh, Sikkim, Meghalaya, Mizoram, Manipur, Nagaland; and
- Coastal plains of West Bengal and Orissa.

2.2. LAND RESOURCE

2.2.1 Per capita availability of total land/net cultivated land in the Eastern Region is lowest in the country. In view of the highest percentage of net sown area to geographical area, there is hardly any scope of enlarging the area under cultivation in this region. Most of the farm holdings are marginal to small, and highly fragmented, hampering the adoption of high-tech agriculture. The need

of the hour is tenurial reform and consolidation of holdings,: the progress achieved in West Bengal in this direction is reflected in the significant growth in production in that State. The soils of the region are relatively fertile and do not have many inherent limitations; however, efforts are required to build up and sustain soil productivity, particularly for intensified agriculture which has to be practiced for faster economic growth.

2.2.2 The North-Eastern Region has a total geographical area of 18.37 million ha of which about 55% is under forest cover. About 1.2 million ha. is under cultivation and about 2.2 million ha is estimated to be not available for cultivation. The climate of the region varies from sub-tropical to extreme alpine type. The normal mean minimum and maximum temperatures vary between 18° C to 32°C in summer and 0°C to 22°C in winter. Heavy fog is a common feature all over the mountain area throughout the year. The temperature in the snow-clad mountains is well below zero degrees. These hill states receive the maximum rainfall in the country and mean annual rainfall varies from 1400 mm to as high as 6000 mm in Arunachal Pradesh. Cheerapunji (Meghalaya) is one of the wettest places in the world, which gets annual rainfall of more than 11000 mm. On the basis of topography, rainfall and temperature, soil type, cropping system and geographical continuity/proximity, the North-Eastern region is classified into following three broadly homogenous sub-regions:

- Himalayan hills of Sikkim and Darjeeling,
- Hills of Arunachal Pradesh, Meghalaya, Nagaland and Assam,
- Southern hills and valleys of Manipur, Tripura and Mizoram.

Physiographically, the region is divided into three units : the hills and mountains of folded topography, the peninsular plateaus and the plains. The altitude ranges from 97 m above mean sea level (msl) in the plains to 5000m msl.

About 80 percent of the culturable area is utilized for crop production and mostly for foodgrain crops. Rice-based cropping system is dominant in the region. Non-rice crops include wheat, maize, pulses, oilseed crops, and cash crops like sugarcane, tobacco, chillies, jute etc. Despite a large water resource, hardly one-fourth of the net sown area is irrigated. The soil and climatic conditions are congenial for growing a large variety of vegetables and fruits. There are numerous pockets covering sizable areas which are favourable for cultivation of potato, turmeric and fruits like litchi, mango, banana and makhana. However, their full production and commercial potential is yet to be harnessed.

2.2.3 Soil degradation: In all the Eastern states more than 30% of the total geographical area suffers from one or the other degradation problem. Among the different degradation problems, soil erosion is predominant in the states of Orissa, Chattisgarh and Jharkhand. In Bihar and West Bengal drainage problems are a predominant concern. Salinity and sodicity problems occur to a considerable extent in West Bengal followed by Chattisgarh, where soil acidity problems occur in as much as 15 percent of the geographical area. Coastal soil salinity is a major problem in the states of West Bengal and Orissa. The North Eastern region suffers acutely from degradation due to soil erosion. The heavy rainfall compounded by deforestation and felling of trees has resulted in increasing levels of run-off and erosion of top soils.

2.2.4 Geology and Soils: The dominating parent materials are gneiss and granites underlined with chlorite-quartz schist. Manipur valley soils have developed from the transported materials formed from shales and are heavier in texture. Mizoram has ferruginous and argillaceous rocks, granites, gray in dull yellow coloured bedded sandstone with laminated iron stained shales and thick zones of pelagic shales and muds. Geologically, the north eastern regions consists of sand stone, silt stone, shale conglomerates and limestones. In some places in Meghalaya and Arunachal Pradesh, granite, gneiss, phylites and

quartzites are also there. Tripura has sedimentary rocks, which range in age from Miocene to loosely consolidated sediments of recent region. Soils are usually rich in organic matter and range from acidic to strongly acidic in reaction. The soils of Meghalaya are deficient in available phosphorous. Practically the entire soils of Tripura, Arunachal Pradesh and Manipur and over 50% of the soils of Nagaland and Sikkim and about 40% of soils of Mizoram are deficient in available phosphorous. Almost all soils of Manipur, Meghalaya, major portion of Mizoram, Kameng and Siang district of Arunachal Pradesh are rated medium in availability of potash. Most of the soils of Tripura (North and South districts), Tuensang and Kohima districts of Nagaland are low and soils of Sikkim and other districts of Arunachal Pradesh (except Kameng and Siang) are rated high in available potash. In most of the soils, the availability of micro nutrients (Zn, Cu, Fe, and Mn) are sufficient, while B and Mo are low.

2.2.5 The North Eastern Region is remarkable for its typical '**jhuming**' system of shifting cultivation. Shifting cultivation has a special significance in the ethos of tribal society and social relationships, cultural values and mythical beliefs. The agricultural operations carry cultural significance for the tribal people and are marked by rituals varying from tribe to tribe. All functions, celebrations and festivities of the tribal people focus on various operations under *jhum* system of agriculture. Naturally, a practice which is so much a part of social, economical, cultural and religious life of the people is difficult to abandon immediately. Unless economically viable, socially acceptable, sustainable and eco-friendly alternatives are provided to the farming community, it would be difficult to abolish the practice of shifting cultivation altogether.

Nagaland has pioneered an excellent method of upgrading *jhum* by interposing a strong and increasing component of agro-forestry through assisted tree planting of selected fastgrowing economic timber, the menu being a product of a meticulous exercise in bio-diversity mapping, documentation and breeding of plant material for widespread propagation. Of Nagaland's 1000 villages, 500

have already been covered, with farmers planting up to 100 trees each in their jhum fields, calculated to yield a harvest of Rs.1 lakh each on a 10 year jhum cycle. Each jhum field being cultivated for two years, tree plantation in the first year with inter-cropping of ginger, tumeric, black pepper, lemon grass, citronella and other suitable varieties could over time result in a more ecologically friendly and viable agro-forestry cycle. Millions of trees have been planted.

In addition, the Nagaland Environment Protection and Economic Development Through People's Action (NEPED) programme has initiated a research programme for developing a package for restoring the tree cover at higher altitudes above the jhum line as these forests have been depleted.

2.3 WATER RESOURCES

2.3.1 The Eastern Region is rich in rain, surface and ground water resources. The average annual rainfall ranges from 1100 to 2000 mm, which is sufficient to meet the agricultural water requirement. There are, however, large spatial and temporal variations which cause immense uncertainty and instability in agricultural productivity and production. While on the one hand, occurrence of long drought spells during crucial periods is quite common, on the other hand, heavy monsoon rains cause water congestion and flooding, making crop cultivation during the kharif season an uncertain venture. Annual surface water flow is abundant (117 M ha-m), but much less is utilizable (36 M ha-m) of which only about one-third has been actually utilized. Ground water potential is also high (30 million ha-m) of which less than 20 percent is being utilized. The total overall utilizable surface water potential for irrigation is about 15 M ha m while it is 12 M ha m for ground water resource. The Eastern region is crisscrossed by large river systems. There are seven major rivers which have catchment area larger than 20,000 sq.km. and four medium rivers which have catchment area larger than 5000 sq. km. The topography of the region renders it vulnerable to recurring floods and waterlogging. In the areas adjoining Nepal, floods are an

annual feature during monsoon months, with all the rivers spilling over into adjacent areas. While the floods do cause considerable distress, to which the affected population has become rather accustomed, the floods facilitate beneficial rabi operations due to silt deposition.

2.3.2 From the point of view of occurrence exploitable ground water, the Eastern region can be divided into five zones:

- Zone of ground water reservoir with ample scope of exploitation, comprising of alluvium of entire Gangetic plain in Eastern U.P., Bihar and West Bengal.
- Zone of ground water with hard and consolidated rocks, comprising of Jharkhand, part of West Bengal, Western and Central part of Orissa and Chhatisgarh region.
- Zone of poor ground water availability, comprising of hill region of Orissa.
- Zone of Artesian ground water reservoir, comprising of Terai region of Bihar, West Bengal, Assam and other foot hills of the Himalayas.
- Zone of coastal ground water resources, consisting of coastal pockets of Orissa State comprising of Balasore, Bhadrak, Cuttack and Kendrapara districts and South 24 Parganas, Midnapur districts of West Bengal.

The utilizable ground water resource for irrigation use and irrigation development at district level for different states depicts an interesting picture. Except Nadia and North 24 Pargana districts of West Bengal, the ground water exploitation level is below 65% in all the districts. Almost the whole Eastern region can be categorized as 'white' and thus there is ample scope of ground water exploitation. However, the actual ground water exploitation is very meager, which is evident from the fact that the exploitation level is below 20% in 25

districts of Orissa out of 30, 6 districts out of 27 in Bihar, all districts of Jharkhand and Chattisgarh (barring Rajgarh), and 6 out of 15 districts of West Bengal.

2.3.3 The progress of creation of irrigation potential under major and medium irrigation systems is very slow in all the Eastern Indian states. The irrigation scenario in Bihar, Orissa and West Bengal is revealing. In the case of minor irrigation systems based on surface water, the rate of progress is higher in Orissa followed by West Bengal and Bihar. But in the case of minor irrigation systems based on ground water, the progress is highest in Bihar and lowest in Orissa. This indicates that Government spending on irrigation development is sluggish in all states but private investment in ground water exploitation is fairly significant. The percent annual growth rate in State financed irrigation systems is just 0.8, 2.1 and 1.8 for major and medium systems, and 1.3, 2.78, and 2.45 for surface flow based minor systems compared to 7.09, 2.79, and 13.5% in privately financed minor irrigation systems, (i.e. based on ground water) of Bihar, Orissa and West Bengal respectively.

The percentage of irrigation potential created is satisfactory in Bihar (62%) and West Bengal (65%), but low in Orissa (33%). The major cause is meagre exploitation of ground water in Orissa. The number of major and medium irrigation projects is highest in Jharkhand(117) followed by Bihar (98), Orissa (87) and West Bengal(37). The least number in West Bengal may be attributed to the plain topography.

The distribution according to source of irrigation shows that canals and wells are the major source of irrigation in Orissa and West Bengal. In Bihar and Eastern U.P., wells outclass canals, while in Chattisgarh canals are the major source of irrigation. In Orissa and West Bengal, tanks irrigate a significant area. This factor needs to be remembered while developing technologies for irrigating rainfed/dryland areas.

Distribution of crops in irrigated areas shows that rice occupies the major chunk in all the States. While in Chattisgarh rice occupies as much as 95%, in Orissa it is 77%. However in Eastern U.P., irrigated rice occupies less area than the national average.

While water resources are inadequately developed, the developed resources are poorly utilized. Canal water for crop production is available in a relatively uncontrolled manner. It is excessive and uneven during the wet season, and too little during the dry season. In most cases, irrigation is practiced from field to field rather than through field channels which results in inefficient water use. Groundwater is developed to a smaller extent and that too is not fully utilized due to inadequate and erratic supply of electric power or non-availability of diesel and maintenance infrastructure.

2.3.4 The North-Eastern region has two major river basins, the Brahmaputra and Barak. The Brahmaputra basin drains an area of 194,413 sq. km stretching through entire Arunachal Pradesh, the greater part of Assam, Meghalaya and Nagaland. The Barak and other basins, draining an area of 78,150 sq. km occupy the northern and western part of Manipur, southern part of Meghalaya and Assam. Both river basins cover 86% of the geographical area of the North East. Per capita and per ha runoff are 21,060 m³ and 44,232 m³ from Brahmaputra and 7,475 m³ and 53,680 m³ from Barak basin respectively. The bulk of the annual rainfall in the region (65%) is received during June to September. Though the North-Eastern states have 5.60% of the total geographical area of the country, they receive 12.13% of the total precipitation in the country. The region has sizable surface and ground water resources mainly because of its location in the high rainfall area with an extensive river system. But the water resources are largely unutilized on account of inaccessibility and difficulty in construction of reservoirs. The total surface water potential of the region (except Sikkim, for which data is not available) is 928,873 Mm³. The region has a total ground water potential of 855 Mm³ (excluding Sikkim).

All the hilly regions have low ground water potential, the lowest being in Sikkim. Most of the surface water in this zone is in a highly dynamic state due to its high gradient and only a very small quantity of fresh water is retained for human use. There is considerable scope for exploiting ground water in Barak valley, Manipur valley and other isolated plains pockets.

2.3.5 By and large the ground water quality of the North Eastern and Eastern regions is suitable for irrigation, except some pockets of coastal districts of Orissa and West Bengal which have saline ground water. The reason for salinity is proximity to the sea and is therefore limited to pockets. In these pockets, the brackish ground water may be used for growing salt tolerant crops such as date palm, spinach, asparagus etc. The other quality problems are high nitrate, high fluoride and low iodine. Except a few localized situations, these problems do not inhibit use of water for irrigation purposes. However, high arsenic content in water has affected nine districts of West Bengal and some parts of Bihar causing arsenic dermatitis to the people, but this water can be used for irrigation purposes.

These water-related constraints along with absence of on-farm water management techniques restrain the farmers from applying required levels of fertilizers and other inputs. Even when used, they yield poor results because of flooding and waterlogging. Thus, the major bane for agricultural development of the region is poor water resources development and management.

2.4 BIO-RESOURCES

2.4.1 Vegetation diversity: The Eastern region of India possesses a distinct identity, not only because of its geography, history and culture but also because of the great diversity in its natural ecosystems. This part of India receives annual rainfall of 100-200 cm and climate varies from dry winter and hot

summer to tropical Savannah. The dominating natural vegetation in the region is moist tropical evergreen and moist tropical deciduous. Physiographically, the entire eastern region could be divided into three regions with different geographical nature and distribution of flora and fauna: Plateau and Hills, Coastal Plains, and Gangetic plains.

The plateau is mainly dominated by deciduous forests, of which timber trees such as Sal (*Shorea robusta*), Sishum (*Dalbergia sisso*) are important. Large areas in this region can be brought under crop diversification. The areas above 500-600 m above mean sea level are congenial for floriculture and cultivation of Orchids, where otherwise there is abundance of tropical deciduous forests.

2.4.2 Forest Resources: The North Eastern states have 143348 sq.km. area under forest cover which constitutes 78% of the total geographical area (State Forest Report 1997). Important forest species found in the region are *Dendrocalamus hamitonii*, *Gamoli arborea*, *Shorea robusta*, *Vitex penduclaris*, *Terminalia belerica*, *Emblica officianalis*, *Schima allichii*, *Bauhinia purpurea* etc. There are several grasses, bamboos and canes and also a wide variety of tree species of economic importance. The region is, therefore, considered to be a mega biodiversity area.

2.4.3 Coastal diversity: The coastal region of Eastern India, which includes one of the worlds most famous mangroves (Sunderbans, West Bengal) and the largest brackish water lake (Chilka, Orissa) is the site of great biodiversity of both flora and fauna. In Chilka, apart from a range of hydrophytes and various aquatic species, which are adapted to varying levels of salinity, many economically important forest trees are found on sandy ridges and islands. Coconut is an important plantation tree in parts of Eastern and North Eastern region. The fauna includes around 158 species of fish and crustaceans, one-fourth of which are economically important.

The mangroves of Sunderbans are dominated by salinity tolerant tree species *Heritiera fomes* (locally known as “Sundari” due to its elegance). The leaf of the ‘golpata’ palm (*Nipa fruticans*), which is abundant here, is used for thatching. Common trees of this region like ‘garjan’ (*Rhizophora* spp.), hental (*Phoenix paludosa*) are source of woods. Sand dunes are partially covered with spear grass, creepers, shrubs or trees such as ‘jhao’ (*Tamarix troupii*), ‘palita’ (*Erythrina variegata*) and ‘kultasi’ (*Aegiceras corniculatus*), which effectively serve as wind breaker and tide barrier, checking soil erosion. The recent super-cyclone had been particularly devastating in coastal areas of Orissa due to large scale removal of such trees which might have acted as effective natural barrier.

2.4.4 Fish resources: The region abounds in perennial and seasonal water bodies which hold high promise for the growth of fishery. In the absence of properly organized fishery production and marketing system, the fishery potential has also not been adequately developed and exploited.

The region has vast potential for fisheries by enhancement of rivers, streams, floodplain, wetlands, reservoirs, lakes, ponds and paddy-cum-fish culture. Of the approximately 806 species inhabiting fresh waters of India, the North Eastern region represents 267 species belonging to 112 genera, amounting to 33.13% of total fish diversity of India.

The important fishes commonly found in the region’s plain and river basins are *Catla catla*, *Labeo rohita*, *Labeio calbase*, *Cirrihinus mirigale*, *Clarius*, *batrachus*, *Rita rita*, *Heteropneustus fonillis*, *Notopterus nontopterus*, *N. Chitala*, *Macrobrachum rosenbergii*, *M. malconsoni*, *M. Chapral*, *Channa punetatus* *C. gaehua*, *C. striatus*.

2.4.5 Livestock resources: Under conditions of relatively small land-human ratio and low agricultural productivity in the Eastern region, animal husbandry

forms a complementary source of employment and livelihood. Its impact is however marginal due to the lack of quality breeds, feeds and fodder, and animal health care.

Livestock rearing is an important enterprise in the North Eastern region. Livestock in this region comprises of cattle (3.2m), buffalo (0.21m), sheep (0.9m), goat (1.07m) and pig (1.43m). In the hills, draught power is used for tilling soils and many of the tribal populations are not accustomed to rearing cattle in the usual sense. Basic problem of livestock rearing is shortage of feed and fodder and absence of commercialized livestock farming. Mithun (*Gravaeus frontalis*) is a large ruminant, confined to the North Eastern region of India and surrounding countries. The animal is very selective in its geographical distribution in some parts of Arunachal Pradesh, Manipur and Nagaland. Another important animal of the region is yak.

2.5 CROPS AND CROPPING PATTERN

2.5.1 Presently due to its high rainfall and waterlogged conditions, rice is the predominant *kharif* crop occupying 70-90% of the entire region under irrigation/rainfed. At some places pulses and oilseeds are also grown as *kharif* crop. Wheat, potato, sugarcane, pulses and oilseeds are the major *rabi* crops while jute is also grown as pre-monsoon crop. The detailed agro ecological sub region wise distribution of existing crops and cropping pattern is presented below and in Appendix 2 :

Agro-ecological sub-region-wise major crops/cropping sequences

Sub region	Crops	Crop sequences
Hot, dry sub-humid BIHAR	<i>Kharif</i> , Rice, maize <i>Rabi</i> : Wheat, barley, gram, lentil, peas, sugarcane <i>Kharif</i> : Maize, millet(upland)	Rice-wheat Rice-rice Rice-potato

	<i>Rabi:</i> Maize, short duration paddy, millet, pulse(mid land) Paddy(lowland) sugarcane	Rice-sugarcane Rice-pulse (residual moisture)
Hot, moist sub-humid ORISSA	<i>Kharif:</i> Groundnut, horsegram, Maize(laterite soil) Rice, til, finger millet, cotton, groundnut, sugarcane (other soils) <i>Rabi:</i> Potato, groundnut, vegetables, sugarcane	- Predominantly monocropping with Cotton/groundnut/maize -Rice-pulse(residual moisture) Millet-maize, maize-mustard Rice-groundnut, rice-vegetable Rice-sugarcane, rice-rice Rice-wheat, rice-potato
Hot, dry, moist, sub-humid JHAR-KHAND	<i>Khari:</i> Rice, maize, <u>ragi</u> , pigeonpea <i>Rabi:</i> Wheat, vegetables, potato	-mainly monocropped -Rice-wheat, rice-potato, rice-vegetables(in irrigated pockets)
Hot, dry, moist, sub-humid BIHAR	<i>Kharif:</i> Sugarcane wheat chillies <i>Rabi:</i> Potato, turmeric	-Rice-wheat, rice-sugarcane, rice-potato -Rice-pulses, rice-mustard, rice-linseed (residual moisture)
Hot, sub-humid to humid WEST BENGAL	<i>Kharif:</i> Rice <i>Rabi:</i> Pulse, oilseed(residual moisture) Sugarcane, potato, vegetables, jute(pre monsoon)	Jute-rice Rice-pulse, oilseeds(residual moisture) Rice-sugarcane, rice-potato, rice-vegetables
Hot, moist sub-humid ORISSA	<i>Kharif:</i> Rice <i>Rabi:</i> Potato (in pockets) Sweet potato (new introduction) Lentil, Coconut	Rice-rice Rice-lentil (relay cropping) Jute-rice-pulse Rice-rice-mung/vegetables

2.5.2 Productivity: West Bengal is the leading producer of rice (13.95 million T.) in the country, accounting for 15.59% of total production. In the

production of maize, Bihar is a close second to Karnataka, with 1.61 million T and 14% of overall production. In total production of foodgrains, West Bengal and Bihar stand fourth and fifth respectively in the country. In terms of productivity too, West Bengal had an average yield per hectare of 2192 kg. against the national average of 1697 kg. The other States, however, lagged below the national average yield: Bihar 1620 kg., Orissa 1022 kg., Assam 1427 kg. West Bengal has recorded remarkable success in raising productivity levels of rice to 2259 kg./ha., against the national average of 1990 kg./ha. However, this is still well below the productivity levels of Punjab, Tamil Nadu and even Karnataka. In Orissa and Bihar the yield gaps are wide in the case of most crops. The following tables give State-wise details relating to the major crops.

Average yield of major crops in Assam

S.No	Crop	Area(M ha)	Irrigated area(%)	Average yield of state (q/ha)
1.	Rice	2.42	21.0	13.45
2.	Total oilseed	0.33	NA	4.74
3.	Mustard	0.29	NA	4.70
4.	Jute and Mesta	0.08	NA	15.29
5.	Sugarcane	0.03	NA	399.9
6.	Potato	0.08	NA	79.86

Source: Agricultural Statistics at a Glance 2000, DOA, MOA

Average yield of major crops in West Bengal

S.No	Crop	Area(M ha)	Irrigated area(%)	Average yield of state (q/ha)
1.	Rice	5.9	26.4	22.25
2.	Wheat	0.37	16.4	21.17
3.	Coarse cereal	0.06	NA	23.14
4.	Maize	0.04	NA	31.48
5.	Gram	6.02	10.3	08.15
6.	Oilseeds	0.49	68.1	07.78
7.	Jute and Mesta	0.62	NA	21.11
8.	Sugarcane	0.03	32.0	744.20
9.	Potato	0.32	NA	210.32

Source: Agricultural Statistics at a Glance 2000, DOA, MOA

Average yield of major crops in Orissa

S.No	Crop	Area(M ha)	Irrigated area(%)	Average yield of state(q/ha)
1.	Rice	4.45	37.0	12.12
2.	Coarse cereals	0.19	9.0	07.75
3.	Maize	0.05	13.3	13.02
4.	Gram	0.03	--	05.94
5.	Arhar	0.14	1.6	06.12
6.	Groundnut	0.08	16.6	09.46
7.	Jute & Mesta	0.03	NA	09.64
8.	Sugarcane	0.02	100	658.97
9.	Potato	0.01	NA	115.75

Source: Agricultural Statistics at a Glance 2000, DOA, MOA

Average yield of major crops in Bihar.

S.No	Crop	Area(M ha)	Irrigated area(%) (1996-97)	Average yield of state(q/ha) (1998-99)
1.	Rice	5.2	40.80	13.01
2.	Wheat	2.10	88.40	19.92
3.	Coarse cereals	0.85	36.40	16.50
4.	Maize(kharif)	0.69	42.80	18.53
5.	Gram	0.13	3.2	07.66
6.	Arhar	0.07	--	14.99
7.	Mustard	0.10	36.9	08.00
8.	Sugarcane	0.11	25.4	485.47
9.	Jute and Meshta	0.16	--	07.71
10.	Potato	0.19	NA	87.51
11.	Onion	0.02	NA	96.43
12.	Tobacco	0.02	82.4	05.00

Source: Agricultural Statistics at a Glance 2000, DOA, MOA

2.6 HORTICULTURE

2.6.1 Horticulture, which includes fruits, vegetables including root and tuber crops, mushroom, floriculture, medicinal and aromatic plants, plantation crops, spices and beekeeping has traditionally been an important activity in the Eastern and North Eastern regions. Horticultural crops grown in these regions include mango, banana, pineapple, guava, litchi among fruits, potato, onion, tomato, cauliflower among vegetables, chrysanthemum, rose, orchids etc. in

flowers, ginger, turmeric large cardamom, coriander, cumin among spices and coconut, arecanut and tea among plantation crops. The productivity of many of the horticultural crops in this region is much below the National level. This weakness of the region can be converted into opportunity, and productivity and production levels can be increased significantly to enhance the total production at national level to meet the ever-growing demand for horticulture produce. Since horticulture provides higher return per unit of land and generates higher employment, development of horticulture also helps in alleviating the economic conditions of people below the poverty line whose number is large in the Eastern and North Eastern region. An important trend observed in the country is that horticulture development has gradually moved out of its rural confines, resulting in adoption of improved technologies and greater commercialization. But in the Eastern and North Eastern region traditional practices continue to result in low productivity. The gap between actual yield and potential yield is comparatively high in the region, which is attributed to production problems related to use of technology and incidence of diseases; poor infrastructure for post harvest management and marketing; knowledge gaps and inadequacy of trained human resources; poor institutional support for dissemination of technologies and information; inadequacy of credit support for investment etc.

One of the major problems being faced in planning for horticulture development in the country is the absence of reliable database on production. State-wise data on production of only a few important horticulture crops is available and that only for important producer states. This problem is more pronounced for North Eastern states for which available database is very sketchy. The problem has been compounded recently by bifurcation of the states of Bihar, U.P. and Madhya Pradesh. Separate data on horticulture production in eastern part of U.P., Jharkhand and Chhatisgarh are not available.

Eastern India contributes significantly to the production of banana, mango, guava, jackfruit and annona. Litchi, makhana and many minor fruits are

unique to the region. Mandarin and pineapple produced in the region have excellent quality. Wide variability exists in mango and banana. However, productivity of most fruits continues to be low compared to national average. An interesting feature in the region is the climatic variability, which provides opportunity for harvest of the crop over an extended period.

2.6.2 Vegetables: Eastern states contribute significantly to production of potato, and productivity is highest in West Bengal. Hills of North Eastern states and plateau region of Jharkhand, Chattisgarh also produce potato during September, much before the usual harvesting period. In major production areas, tomato, capsicum, brinjal, cauliflower, cabbage are also important vegetables. Cucurbits like cucumber, melons, parwal contribute significantly to production of vegetables in Eastern India. Parwal is a unique vegetable in Eastern India, which is also used for sweetmeats. Among the tuber crops, sweet potato has been an important crop but area and production has declined in the of last few years. Besides, there are various species of tubers which are important components of horticulture produce of this region.

2.6.3 Floriculture: India has diverse agro climatic conditions which permit growing of different varieties of flowers throughout the year. Besides traditional flowers such as jasmine, marigold, chrysanthemum, tuberose, crossandras and aster, cut flowers such as rose, orchids, gladiolus, carnation, anthurium, gerbera and lilies have become popular for commercial floriculture. Total area under floriculture in the country is 73971 ha. with an estimated production of 4.6 lakh MT of loose flowers and 1156.13 lakh MT of cut flowers. India is home to about 1300 species of orchids, of which about 800 are found in the North Eastern region of the country. Eastern Himalayas are not only rich in terms of number of species, but more importantly many of them rank at the top of the list of ornamentally important ones. Besides, many cut flowers like carnation, chrysanthemum, aster, rose etc are successfully grown in all the states of North Eastern region. West Bengal has exploited floriculture to some extent, but lags

behind in recent technological developments. Potential of floriculture remains largely unexploited in Eastern region. Ranchi of Jharkhand state is known to grow excellent quality of roses and chrysanthemum, but their commercial exploitation is negligible. There exists ample opportunity for the development of floriculture in the region. The strength of the region in floriculture is there to be exploited through well planned strategies.

2.6.4 Spices: India is known for its wealth in spices, producing more than 50 varieties. Almost all the states grow one or more spices. The area covered under various spices in the country is estimated to be 2.5 million ha with an annual production of 2.87 million tonnes. More than 90% of the spices produced in the country is used for domestic consumption and the rest are exported as raw as well as value added products. India produces a wide variety of spices like black pepper, cardamom, ginger, turmeric, chillies etc. and spices occupy an important place among the agro products exported. North Eastern region has significant share in the production of spices especially ginger, turmeric, chillies, garlic and coriander. Introduction of black pepper in the region has been highly successful. Small scale production of organically grown spices in Orissa has also been quite successful. There is wide scope for growing of organic spices in the region. In the growing of ginger, improvement of cultivars and production technology coupled with post harvest management and processing would not only improve the productivity but enhance economic viability. Large cardamom is unique to the region. Demand for this spice is increasing. Full exploitation of its potential should be attempted. Other spices and herbal spices also hold considerable potential.

2.6.5 Plantation Crops: Among plantation crops coconut, arecanut, cocoa and cashewnut find place in the region. Coconut is grown in Orissa, West Bengal, Assam and during the last decade there has been substantial increase in area and production of coconut in Bihar. Arecanut is a traditional crop of Assam and Northern parts of West Bengal. Cocoa, although not grown in the region at present, has good potential considering the favourable climatic conditions.

Similarly, cashewnut is an important crop in Orissa and has expanded to the plateau region of Bengal, Jharkhand and Chattisgarh. Cashewnut is also successfully grown in Meghalaya, Tripura and Manipur. What would be needed is to improve the profitability of these crops through improved production technology and cultivars coupled with good system of marketing.

Betel vine is an important commercial crop in the region, and the region has excellent cultivars for commerce exploration. The crop provides livelihood to a large number of small and marginal farmers, as it has potential to give higher income per unit of land. However, in the traditional system of cultivation, yield is low and the problem is faced of incidence of a number of diseases. Export of this crop from the country is estimated to be over Rs.1, 000 crores and area under production in the country is about 45,000 hectare.

Among plantation crops, tea is well established but is capable of expansion and requires rejuvenation in certain areas. The small-grower movement has spread and could be the wave of the future. These small holders either sell their produce to established large producers for processing in their factories, as Arunachal foothill-growers are doing across the border in Assam, or could be cooperativised and supported by apex organizations with the necessary processing and marketing facilities of which there is a good example in Tripura. Upland teas in Meghalaya, Arunachal and the other hill regions have a potential that awaits exploitation. They could provide special varieties and flavours to add both to quantity and quality in tea production.

Rubber is doing well in Tripura which now ranks second only to Kerala in production. Here again the small holder must lead the way. The Rubber Board is doing good work in the States and has adopted farmers who have pooled their lands for rubber cultivation under its supervision. This is an interesting model that could be replicated elsewhere and in respect of other plantation crops. It is necessary to develop processing facilities and encourage

manufacture of a variety of rubber products which could be marketed in the eastern region and would, in turn, stimulate demand and expansion of acreage. Some 50,000 Jhumia families in Tripura face acute problems of poverty and under-employment. Of all the resettlement projects taken up, tribal rehabilitation in rubber plantations has been found to be possibly the most effective, as it provides continuous employment till the plant attains maturity and subsequently on a long-term basis through tapping of rubber. About 5,000 hectares have been brought under rubber for tribal rehabilitation so far.

2.6.6 Medicinal & Aromatic Plants: Medicinal and aromatic plants form another important component of horticultural commodities. There is a wide gap in demand and production for industrial use. Besides, medicinal plants are also used by a large proportion of rural and urban population. With growing awareness of health care using herbal products, there is renewed interest in exploitation of traditional medicine. The principal plants are aloe, ammi, majnis, dijitalis, ginseng, guggul, isabgol, liquorice, poduphyllum, rauwolfia, aonla etc. Important aromatic plants are lemon grass, vitevar, patcholi, palmarosa, citronella, mint, geranium, lavender, baris, jasmine etc. Medicinal plants have received national focus and a Medicinal Plants Board has been established under the Department of Indian System of Medicines and Homeopathy. North Eastern states and Eastern states provide excellent opportunity for the development of medicinal plants. The demand for organically grown medicinal plants can be met from this region.

2.6.7 The immediate problem in the context of horticultural produce is of infrastructure, especially road and transport facilities, availability of power, input support systems like seeds, credit, etc. Power supply is erratic and costly, which is an impediment in promotion of processing facilities. Departmental support systems are also very weak. In Bengal, Department of Food Processing has been created but there is no ground level staff. Same is the situation in Bihar and

Eastern Uttar Pradesh. This would need to be reviewed so that State Governments can meet the growing needs for horticulture development.

2.6 ANIMAL HUSBANDRY

2.7.1 The Livestock and Fishery Sectors provide fish, milk, egg, wool and meat and much needed employment, especially of women, landless, small and marginal farmers etc., and also cater to several needs of the economy, such as agricultural operations, transport, income generation, fuel and fertilizers, utilization of agricultural by-products and wastelands. India today ranks first in cattle and buffalo, second in goats, third in sheep and seventh in poultry population in the world. About 56% of the world's buffalo population is in India.

Livestock production is an integral part of crop farming and contributes substantially to household nutritional security and poverty alleviation through increased household incomes. The returns from livestock especially dairying and mixed farming in small and medium holdings can be highly sustainable. Development of this sector, therefore, will result in more balanced development of the rural economy and improvement in the economic status of poor people associated with livestock.

The production of milk, egg and fish rose from 17.0 million tonnes, 1832 million nos., 0.75 million tonnes in 1950-51 to 74.7 million tonnes 30.2 billion nos., and 5.26 million tonnes respectively in 1998-99, is a major leap forward. The contribution of Livestock and Fishery sector to total GDP was 7.39% (6.01% from Livestock and 1.39% from Fisheries) in 1998-99 at current prices. The value of output of livestock and fisheries sectors was estimated to be Rs.1,48,954 crores during 1998-99 which is about 27% of the total value of output of Rs.5,53,175 crores from the Agricultural & Allied sector. This does not include Draught Animal Power which has been valued between Rs.40 and 95 billion. The contribution of milk alone (Rs.82,624 crores) was higher than paddy (Rs.68,230 crores), wheat (Rs.40,323 crores) and sugarcane (Rs.23,314 crores).

The overall labour investment in livestock farming in small and medium holdings is high (around 73%) compared to crop farming (23%). Women constitute 71% of the labour force in the livestock sector as against 33% in crop farming. It is estimated that about 9.8 million people are directly involved in the livestock sector in principal status and another 8.6 million are involved in the subsidiary status.

Looking to the contribution of the livestock and fisheries sectors to the GDP, the higher growth rates of between 4 and 5% for milk, meat, egg and fish, the need for increasing animal protein in the food basket and the potential of livestock in rural transformation and employment, it is essential that the Livestock and Fisheries sectors receive higher focus in coming years.

Due to reasons of history, the Eastern and North Eastern regions of the country have not been able to keep pace in agricultural production including animal husbandry and dairying, as compared to other regions of the country. The main stumbling block is the lack of basic infrastructure including road communication, marketing and input supplies. This region has about 320 lakh human population, 86% of whom live in the rural areas (India-73%). The region's 39 lakh milch bovine (92% cow) produce some 26 lakh litres of milk per day, while 21% (India-7%) of the breedable bovine have either never calved or are kept for non-milk purposes. Milk availability per capita (except for Sikkim) is generally much lower than the Indian average. Estimated productivity of the region per lactating animal (1.03 lit/day) is much lower than India's (2.91 lit/day), though the number of milch animals per household are comparable (0.69 and 0.65 animals, respectively). This region also has the largest number of non-descript animals in the country among the population predominantly of tribals and other socially and economically deprived groups, who are landless, small and marginal farmers. The Government of India, through the Centrally Sponsored Schemes, have been supplementing the State Governments' efforts in livestock

development. During the Ninth Plan, cattle breed improvement programmes like Extension of Frozen Semen Technology, National Bull Production Programme, Progeny Testing, Ram and Duck production, piggery and poultry development, Integrated Dairy Development have been implemented. However, the capacity of absorption of funds released by the Government of India has been found to be wanting in various respects. In fact, many of the States have not even availed the schemes, though it is on hundred per cent grant basis, which is so vital for enhancing the per capita income of the poor farmers.

2.7.2 Dairy Development: The successful implementation of “Operation Flood” between 1970-1996 has brought India to the forefront of milk production in the world. Milk production which was about 17 million tonnes in 1950-51, has risen to 78.1 million tonnes in 1999-2000. The growth rate for the past three decades has been around 4% as against the growth rate of about 2% in our population. The per capita availability of milk, which was 124 grams per capita per day in 1950-51, decreased to 112 grams per day before the advent of Operation Flood in 1970. The per capita availability has now increased to 217 grams per day, which is slightly less than 220 grams minimum nutritional requirement suggested by Indian Council of Medical Research.

The benefits of “Operation Flood” by and large could not reach Eastern and the North-East India primarily due to the reason that “Operation Flood” was confined to those regions which were better endowed and relatively higher in productivity, with easy access to urban and peri-urban markets. The state of dairying in the Eastern and North-Eastern regions is clearly reflected by the fact that there are only 6,748 village dairy cooperatives in Eastern region as against the total of 84,289 in the entire country. Further, analysis indicates that the States of Bihar, Orissa and West Bengal constitute about 95% of the dairy cooperatives in this region. In other words, dairying in other States of the region is almost nil. There are only 398,000 farmer members as against 10.6 million farmer members in the whole country, and only 524 tonne kilograms per day of

milk is procured in the region as against 15,718 tonne kgs. per day in the country as a whole. In fact, the States of Assam and Tripura procure only 2,000 and 1,000 kgs. per day, respectively. Details may be seen in Appendix 3.

It is evident from the above facts that livestock and dairy development programmes have not received the impetus they deserve in the region.

2.7.3 Development of Poultry & small ruminants: One of the emerging areas is the market acceptability of goat meat and its growth potential. The North Eastern and Eastern states have immense potential to exploit this sector. The advent of stall feeding technology for production of goats provide scope to generate employment opportunities to the educated rural poor. A central program needs to be initiated to popularize the technology in location specific areas.

In the North Eastern states pig breeding and the popularity of pork provides an instrument for social upliftment in this area. It is essential that this sector be exploited fully by providing appropriate inputs in terms of genetic material, health coverage, value addition and marketing. Given the right incentives and programmes this sector can transform the social scenario.

Poultry development in the country has taken a quantum leap in the last three decades emerging from a mere backyard practice to a venture of industrial proportions. In spite of commercialization of the poultry sector, unorganized rural poultry production still contributes around 30 to 40% of eggs and broiler production. This sector still needs to be serviced by State interventions as the possibility of private sector extending their services to the rural sector is limited in this region. In order to support rural poultry production, poultry establishments of the Government need to concentrate on programs to support rural poultry production and other avian species till the private sector

ensures availability and marketing in the rural areas. The problem of poultry development in the Eastern and North Eastern regions, basically hinges on non-availability of proper feed and hatcheries. In fact, the cost of production of poultry products in this region is prohibitive, due to high cost of feed, especially maize. Impetus, therefore, needs to be on production of cereals, especially maize, so that the farmer is able to earn profit on the poultry products.

2.7.4 Piggery Development: Piggery is an important activity among weaker sections of society. It is a major animal husbandry activity in the North Eastern region, where pork is an important food. Indigenous pig breeds need to be improved through crossbreeding with exotic breeds. Nagaland and Mizoram have done quite well in piggery development. More than 80% of the population in the North-East rear pigs.

The Government of India is implementing a scheme "Assistance to States for Integrated Piggery Development" to strengthen State Pig Breeding Farms and to assist them in genetic improvement. It is aimed that in next 20 years all the Government Pig Breeding Farms will be able to supply to the farmers the number of the exotic pigs required for cross-breeding.

2.7.5 Animal Health: In the absence of an integrated approach to deal with animal health, there has been a large mortality and morbidity rate causing huge losses to the farmers, which they can ill-afford to bear. The prevalence of foot and mouth disease, swine fever and avian flu, are important factors affecting animal health. Eradication and control of diseases is a great challenge to the experts, as these diseases have far-reaching spatial externalities, giving rise to regional problems. This is specially true in the context of the States which have open boundaries with Bangladesh, Burma and Bhutan. Lack of regional coordination amongst the North Eastern States and interface with the neighbouring countries in tackling animal diseases will have serious implications on animal and human health. As already observed, the State Governments of

this region have no wherewithal to tackle the problem of animal health. The Central Government will have to intervene as the problem of disease control in this region has spatial implications. This is all the more important as many of the diseases like avian flu, with increase in the human animal interface, can cause zoonotic problems. The lack of biological products and disease diagnostic laboratories are also contributing to the already ailing animal health care programmes in this region. There is only one veterinary biological Institute in the whole North East; the Veterinary Biological Product Institute, located at Guwahati, Assam. This Institute too is limping due to dearth of budgetary support. The biological units currently being operated under the State Governments to provide immuno biologicals to the farmers would need critical evaluation in terms of cost effectiveness and quality of the product.

Recent studies on livestock health and breeding indicate that the users of health and AI services and breeding inputs, are otherwise informally paying the price for the services provided to them and the prices paid are significantly higher than prescribed by the Government. It also indicates that the Government veterinarians are paying frequent visits to homes of users, of course, for a consideration. It is revealing to note that there is a positive willingness to pay for the services by all income groups, including the poor. Given the fact that these services have direct impact on the productivity of livestock, price does not seem to be an important determinant for the use of these services.

Veterinary services, despite the priority assigned by the Government, has lagged behind due to various reasons in terms updating of knowledge, technology and training. It is essential for efficient delivery of the services, both primary and specialized, to make provision for retraining, refresher courses, and hands on training in emerging areas etc.

2.7.6 Feed and Fodder: Feed and fodder is one of the most important inputs in dairy development. Grazing is the most important source of dry matter for cattle and other ruminants. Most grazing takes place in the forest areas, non-arable land, permanent pastures etc. The total area covered by these categories of land, in the country, shrank by about 30% (23 million hectares) between 1950 and 1998. The total area under green fodder in the country is about 8.3 million hectares or 5% of the total cultivated area. The entire North-East region, which accounts for 8% of the total land area in the country, has 26% of the country's forest cover. Pressure from grazing has contributed to a considerable degradation in the forest area.

Backyard poultry and breeding of pigs is the main vocation of the people of North-East. The cost of feed for the use of pig and poultry has been a major cause for concern. The popularity of pig breeding in the North-East is reflected in the growth of livestock population during 1987-1997. Though there has been a substantial decrease in the population of non-descript cattle in Manipur from 7.04 to 4.39 lakhs, a decrease of 37.64%, the population of pigs increased by about 40.91% during the same period. Similarly the population of poultry has also attained significant growth. The high cost of feed, however, may drive the farmers out of this vocation. It is estimated that already about 30% of families have left animal husbandry in Manipur due to the high cost of feed and fodder. This region paradoxically, is deficient in poultry, dairy and meat products, despite substantial increase in the pig and poultry population. For example, Manipur and Nagaland are getting eggs and skimmed milk powder from Andhra Pradesh and Gujarat respectively.

The rich bio-mass of the North-Eastern States and parts of West Bengal, Orissa, can be a potential area for providing fodder for livestock development. However, a scientific approach is needed. Location specific fodder development like Deenanath grass for hilly areas, identification of other appropriate fodder species in association with ICAR, and its propagation, is the need of hour. Production of fodder seeds through the National Seeds Corporation,

cooperatives and local bodies will go a long way in meeting the fodder demand in this region. In order to encourage private investment in this sector, the region needs to set up processing plants, using appropriate technologies, with private equity participation so that the crop residues are converted into nutritive feed at a reasonable cost.

2.8 FISHERIES

2.8.1 The country has large potential for rural aquaculture, which contributes considerably to improve the livelihood of rural inhabitants. It is estimated that for every fisherman engaged in primary fishing activity, about four others will benefit from additional employment by way of post harvest operations, marketing and other allied activities. The Eastern and North Eastern regions hold considerable potential for both inland as well as marine fisheries.

2.8.2 Inland Fisheries: Some of the major river systems are located in the Eastern and North Eastern parts of the country. The Ganga and Brahmaputra rivers and their innumerable tributaries constitute a major source of inland fisheries of the country. These water bodies and the associated flood plain lakes are extremely rich in nutrients and are capable of yielding excellent harvests subject to scientific management. The fisheries of the flood plains and wet lands received attention only during the Ninth Plan, when schemes were initiated for development of flood plain fisheries in Uttar Pradesh and Bihar, with the assistance of the World Bank. A similar project was initiated in Assam.

Similarly, estuarine systems of Eastern India hold considerable promise in fish and shrimp breeding. The fisheries of estuaries in India provide comparatively high yields, which are above the subsistence level. Commissioning of the Farakka Barrage has increased the volumes of water in the Hooghli estuaries and has had a positive impact. Another good source of fisheries is reservoirs, in connection with which projects are under implementation in Orissa and Uttar Pradesh. The North Eastern region holds considerable scope for up-land and cold water fisheries which, however, is poorly developed.

2.8.3 Marine Fisheries: The potential for Marine fisheries in Eastern India has not been exploited to the extent it has been on the southern and western coasts. Hence, while Marine Fish production is said to have reached a plateau, in Eastern India there may still be scope to increase production to the optimum sustainable level. Moreover, deep-sea fishery resources can also be exploited by diversification of existing infrastructure, introduction of modern vessels and equipments.

2.8.4 Culture Fisheries: The contribution of Inland Fisheries to overall fish production in the country has increased from 29% in 1951 to almost 50% in 1999-2000. The share of aquaculture in total inland fish production is estimated to be about 75 to 80%. The Eastern and North Eastern regions are extremely well placed to achieve still higher production in inland aquaculture. Besides fresh water aquaculture, cold water aquaculture in mid and high altitude lakes, rivers and reservoirs may be exploited. However, these cold water fishery resources remain largely untapped due to lack of developmental and scientific efforts. Coastal aquaculture, mari-culture and ornamental fisheries also provide opportunities for increasing production and incomes in the region.

2.9 POST-HARVEST MANAGEMENT

2.9.1 This sector constitutes the major weakness of the Eastern and North Eastern regions. With regard to all commodities – agricultural, horticultural, livestock and fisheries – this is an area needing special attention. Horticultural commodities being perishable are vulnerable to high losses after harvest, till these reach the consumer. Depending upon crops and season of harvest, estimated losses range from 8-37 per cent, resulting in annual loss of more than Rs.10,000 crores in the country. These losses are much higher in North Eastern and Eastern India owing to poor post harvest handling infrastructure, unreliable transportation system and inadequate road network.

Insufficient infrastructure, at the level of farms, unhygienic market conditions as also poor protection against sun and rain have considerably added to these losses. The type of infrastructure needed to ensure equitable returns to producers and which are essential for value addition like plastic crates, grading / packing centres, pre-cooling and cold storage facilities, auction platforms, transport systems and facilities at airport are yet to be established in the region. A feasibility study got conducted by the Department of Agriculture & Cooperation has emphasized that establishment of alternative market systems having backward and forward linkages are essential in efforts to achieve higher productivity and ensure returns to growers. It has been suggested that the system should have terminal markets with auction centres having modern facilities, backward linkages with farmers through collection centers, and forward linkages with consumers through retail sale centres. This system of market is viable and can be operated by cooperatives or companies. Government has to play the role of facilitator through policy reforms. APMC regulations have to be modified to facilitate free trade with minimal restrictions.

2.9.2 Schemes for creating post harvest infrastructure for horticulture in the form of cool chambers and cold storage have been very successful and a substantial additional capacity has been created in the country in a short period of time. This scheme, operated through National Horticulture Board is a credit linked back ended subsidy scheme. Unfortunately, the scheme has not had much impact in North Eastern and Eastern states. One of the factors has been absence of an effective system for provision of credit support. Cooperative institutions being very weak in the region, especially in the North Eastern states, are unable to support creation of storage infrastructure.

2.9.3 Quality consciousness is growing in the domestic market, but in the context of export, quality standards are much more stringent. The Directorate of Marketing and Inspection has been promoting standards and grading of products at the National level, popularly known as Agmark, but these standards have been

implemented only to a limited extent in this region. At the international level, Codex standards lay down procedure for assessing the quality of produce. Packhouse concept has been introduced in the country which has been limited to high value produce, especially in export oriented crops. Through assurance of quality produce, there exists considerable potential for export of horticulture produce from the North Eastern states on a large scale. Neighboring countries, adjoining North Eastern states provide huge opportunities for export. Eastern India too has several crops which have vast export potential, like litchi, cashew, makhana, flowers, medicinal plants etc.

2.9.4 Adequate infrastructure is also a basic requirement for the development of fisheries. Strengthening of infrastructure development at the capture and culture phase, and also post harvest infrastructure such as storage facilities, ice plants, cold chains, transportation etc, as well as an effective marketing system are key requirements. The Eastern and North Eastern regions are particularly handicapped in terms of supporting infrastructure for the fisheries sector. Indeed, despite excellent production potential of the region, large quantities of fish are imported from other parts of the country to the region. The marketing chain also is disorganized, on account of which the producer is denied remunerative returns. Lack of storage and preservation facilities has limited the scale of operations. Other requirements of the sector are provision of credit, manpower development, quality control arrangements etc.

2.10 **Marketing:** Marketing is the key instrument in the development of the agriculture sector. The success story of dairy development in the country through the cooperatives, was largely due to an effective marketing network created by the National Dairy Development Board. Unfortunately, marketing seems to have taken the back seat in the context of Eastern and North-Eastern States, though the States have been implementing programmes to increase agriculture, horticulture and livestock productivity, for the last several Five Year Plans. The reason why poultry products and milk is flowing into this region from

outside points to the inadequacies of marketing infrastructure in the region. The region seems to be caught in a 'Catch-22' situation; though there is excellent demand for products of the region, the farmers are not able to produce and receive fair remuneration due to the high cost of input supplies and a non-existent marketing network. Due to the small size of the North Eastern States, many of the institutions set up for economic development by the respective State Governments, have proved to be unviable. State Governments tend to think and plan in the framework of their geographical boundaries only.

Though the Eastern and North Eastern region has great potential in the animal husbandry sector, the same has not been exploited to the extent it should have been due to reasons of inaccessibility, lack of marketing network, poor infrastructure and delivery system. Though some infrastructure has been created by each of the States in the region, for instance in terms of AI centres, breeding farms, liquid semen banks, hatcheries, liquid nitrogen plant etc. in the livestock sector, most of these are lying in disuse due to sheer lack of budgetary support and unsupportable burden on the meager resources of the respective Governments. The reasons for the non utilization of infrastructure is largely due to prohibitive cost of inputs, non-availability of effective transportation and delivery system.

2.11 Research and transfer of technology: In the North Eastern region, there are two agricultural universities, one at Jorhat and the other at Manipur, and a Central Research Complex of Indian Council of Agricultural Research, at Barapani, Meghalaya for research, technological development and support. Research Complex of ICAR has its regional stations in all the states. A National Research Centre for Orchid is located in Sikkim which has focussed research on orchids and other flowers. In the animal husbandry sector, National Research Centres on Mithun and Yak are located at Kohima and Dirang (Arunachal Pradesh) respectively. A list of ICAR institutions is given in Appendix-4.

Bihar and Jharkhand, Eastern Uttar Pradesh, Orissa, Chattisgarh and West Bengal have one agricultural university each, besides Coordinated Centres for agricultural and horticultural crops located in these states. The Central Institute for Jute and Allied Fibers is located at Barrackpore and the Central Rice Research Institute at Bhubaneswar. The Water Technology Centre for Eastern Region is based in Bhubaneswar, as also the National Research Centre for Women in Agriculture. In the fisheries sector, the Eastern Region has the Central Inland Capture Fisheries Research Institute (Barrackpore) and Central Institute for Freshwater Aquaculture (Bhubaneswar). In Bihar, regional centres for horticulture and potato are located and the National Centre for Litchi is planned. It has generally been felt that an effective linkage does not exist between ICAR institutions and SAUs and developmental agencies of the states, especially in the North Eastern states. The result is that information about new technologies does not reach the growers in adequate measure and their application in the field is poor.

Dissemination of information about new technologies and management practices is very weak in the region. There exists a wide knowledge gap which has to be bridged. The extension network needs to be strengthened significantly. The manpower available with state agencies needs to be trained to

improve their knowledge and skills. Special attention is required towards imparting commercial orientation to the manpower engaged in development activities.

2.12 CREDIT

The economy of the Eastern and North Eastern Regions still persists on production for consumption rather than creation of marketable surplus. The banking industry, and banking habits in general, are yet to be fully developed and understood. The financial position and health of Regional Rural Banks and Cooperative Banks is precarious and the aggregate accumulative losses are very high. Moreover, the business level of the Banks is low, thereby affecting their viability, and due to various reasons the recovery level of advances is extremely poor. By and large, financial losses in most of the Banks in the region are mounting. Due to the weak financial position of the Banks, constraints were also faced in the flow of refinance from NABARD. Innovative schemes such as Kisan Credit Cards, creation of Self Help Groups and other Micro Credit Schemes, have not gained ground in these States. It is significant that whereas the average flow of agricultural credit is around Rs.5,000/- per ha. in Kerala, in the North-East it is merely Rs.25/-.

Primary Agricultural Credit Societies (PACS) are the vital link in the cooperative credit structure. The PACS system in the region, however, is financially and operationally weak and far from becoming self-reliant in respect of mobilization of resources through deposits. The PACS transact small volumes of business and their membership is declining, resulting in high cost of management and imbalances in outstandings. Any strategy for development of rural financial institutions in the North-Eastern region, as also in Eastern India, must promote greater involvement and participation of the local people and institutions, and to this extent legal and structural reforms may be required. (Details regarding the banking system in the Eastern and North eastern States are given in Appendix 5,6 and 7.)

3. Problems and Constraints

3.1 Legacy of Backwardness: Most parts of the Eastern region lag behind rest of India with respect to several social indicators. For instance, Bihar and Orissa rank lowest in poverty ratio and infant mortality is highest in Orissa among all major states of India. Development levels vary greatly within the Eastern region. Even within states like Orissa, the coastal and Northern regions have rural poverty head-count ratios of 45 to 46 percent, but the Southern districts have 69 percent of rural population below the poverty line making this the poorest area in rural India. Agriculture dominates the economy, accounting for 33%, 32.8% and 26.7% of Gross State Domestic Product respectively in Assam, Uttar Pradesh and Bihar in 1990-2000 as compared to the all India average of 25.2 percent (at 1993-94 prices).

Social development indicators: Selected states (mid-1990s).

Indicaetors	Unit	Orissa	All India	Best State	Worst State
Poverty ratio	Percent	48.7	36.1	11.5(Punjab)	55.2(Bihar)
Infant mortality	Per '000	105.0	72.0	16.0(Kerala)	105.0(Orissa)
Overall literacy	Percent	51.2	56.5	91.6(Kerala)	42.0(Bihar)
Female literacy	Percent	38.9	43.9	88.5(Kerala)	22.0(Rajasthan)

Source: CMIE, Profile of states of various years and Economic Survey, GOI, various years

In terms of average per capita Gross State Domestic Product, the Eastern region lags way behind the rest of India. For instance, in the mid-1990s, Orissa's per capita GSDP was only Rs.1830 as compared to the national average of Rs.3171. Average per capita income of Bihar and Orissa was the lowest among major Indian states. Growth in GSDP too in Eastern States has been below the national average for major States. For the overall period (1980-97), Bihar and Orissa recorded the slowest growth. The main reason for slow income growth in

Eastern States has been slow agricultural growth in all time-periods as compared to the all India level, and indeed, at or below population growth rate.

Growth in GSDP and agriculture sector in Eastern States in 1980-97

States	1980-85	1985-90	1990-96	1980-97
Annual average growth rate in GSDP %				
Orissa	4.0	3.6	3.7	3.5
ER states (Orissa, MP, UP and Bihar)	4.2	5.1	3.0	3.9
All India	5.0	6.4	6.0	5.5
Annual average growth rate in Agriculture sector. Per cent				
Orissa	3.1	-1.4	0.2	1.8@
ER states (Orissa, MP, UP and Bihar)	3.2	1.7	1.0	1.5
All India	3.2	4.6	2.7	3.0

@For the period ending 1995-96 since 1996-97 was a drought year for Orissa. If this year is included, growth rate becomes zero. Source: Agricultural Statistics at a Glance 2000, DOA, MOA

3.2 Dependence on traditional agriculture: Sluggish growth of the agriculture sector in the Eastern region is mainly due to low irrigation coverage, erratic climate with deviations in rainfall of 20% or more every third year for the last thirty years or so, and, most strikingly, a very high degree of dependence on a single crop, namely rice, which occupies 93.5% of the foodgrains grown. Given the water intensive nature of rice, such reliance on it, where neither nature nor irrigation can be depended on for water, is risky indeed. Agricultural growth in the Eastern states averaged just over 1% per annum over the last two decades. Irrigation water management, excess water management, rain water management, watershed management and ground water management assume greater significance now than ever before for aiding future agricultural growth in the Eastern region while evolving agroclimatic region specific production and resource management technologies.

The Eastern region, which was one of the most developed and prosperous regions of the country prior to independence, is presently prone to a number of biophysical, institutional and socio-economic constraints. This has resulted in a peculiar subsistence agriculture with low input, low yield, low risk

technology. Average farm size, irrigation coverage, average fertilizer consumption and power consumption in agriculture are all below the national average. Average fertilizer consumption in Orissa is lowest of any Indian state. The cumulative result of these factors is low productivity and near stagnation or marginal growth in agriculture sector during the recent years.

Agricultural indications in Eastern States (mid-1990s)

Indicators	Unit	All India	Orissa	Bihar	Chhatis-garh	U.P.
Average size of operational holding	Ha	1.6	1.3	0.9	2.6	0.39
Marginal holdings as a % of total	%	59.0	53.6	76.6	37.3	73.8
Net irrigated area as a % of net sown area	%	35.1	32.8	46.7	24.4	65.6
Fertilizer consumption	Kg/ha	74.8	25.2	77.0	34.7	101.4
Power consumption in agriculture	KWH/'000 ha	379	35	142	228	351
Yield of food grains	kg/ha	1547	1250	1480	1080	1920
Rice production as % of food grains	%	42.8	93.5	52.5	25.8	29.1

Source: CMIE, Profile of states for various years: Economic Survey and Agricultural Statistics at a glance, Govt. of India.

3.3 Inadequate Infrastructure: The Eastern region faces a serious constraint in terms of infrastructure. On most criteria, Eastern States lag behind the all India average. Orissa, for instance suffers from poor railway and telecommunication infrastructure. Orissa does well in terms of roads, but only for unpaved roads. With weak rural infrastructure, farmers concentrate overwhelmingly on rice cultivation, aided by canal irrigation based supply-led cropping pattern further confounded by lack of adequate drainage network. Water management technologies in conjunction with rural infrastructure development would wean the farmers away from rice monocropping towards crop/farm diversification.

Reforms in the irrigation sector have been initiated only in Orissa within the Eastern region. Decentralization of the management of irrigation systems at various levels is happening now with the formation of water users' associations at minor, distributary and project level. Surface irrigation systems are getting rehabilitated and consolidated for facilitating the take over of system maintenance and water distribution responsibilities to the water users themselves.

Infrastructure in India and Eastern states in mid-1990s.

Infrastructure	Unit	All India	Orissa	Bihar	M.P.	U.P.
Railways	Km/ '000 sq.km	19.1	14.1	30.2	13.3.	30.3
Road Length	Km. per '000	731	1350	492	449	806
	Vehicle density per sq.km.	8.3	3.5	7.0	4.3	8.3
	Percent surfaced roads	55.5	19.9	38.5	44.1	52.4
Telecommuni- Cations	Lines per 100 persons	0.9	0.4	0.2	0.7	0.4
Post offices	Per 10 sq. Km.	0.5	0.5	0.7	0.3	0.7
Power utilities	Plant load Factor of SEB thermal Plants	NA	21.2	17.4	58.7	47.3
	Surplus/deficit As % of Requirement	NA	-4.7	-30.1	-8.8	-11.4
Petroleum Consumption	Kg. Per person	68.1	38.4	31.5	39.7	43.8

Source: CMIE. Profile of states for various years and Economic Survey GOI, various years

3.4 High rainfall and humidity: The high rainfall and humidity of the region not only creates favourable environment for a wide range of pests, diseases and weeds, but also creates problems in application of current prevalent technological approaches based on inorganic fertilizer application and chemical control measures through spraying and dusting.

3.5 **Waterlogging:** Waterlogging is generally understood as stagnation of water on the land surface. However, an area is also classified as waterlogged if the water table is within 2 meters of the land surface which is the case in most of the plain areas of the Eastern region during rainy season. It also occurs when there is an application of more than the required amount of water in the field with restricted drainage. Waterlogging is caused both by natural and man made factors in Eastern India due to deforestation and poor upkeep of watersheds and poor natural drainage, heavy losses of water due to seepage of water into canals, distributories and water courses, etc., and poor on-farm water management. The problem is further compounded in parts of Eastern India bordering the Himalayan foothills, where overflowing rivers and streams during the monsoon result in prolonged periods of water-logging.

3.6 **Tal, Diara and Chours:** Bihar consists of large areas of Tal, Diara and Chours. A sizable population lives in this area and is fully dependent on agriculture. Due to various complex problems, agricultural practices in these areas result in low yields, damaged crops, improper water management, high pest pressure, etc. The Tal area in Bihar extends from Fatuah to Lakhisarai over an area of about 1034 sq. km with a length of 105 km. The topography of tal area is such that rain water of 1150 sq miles area is accumulated and this accumulation goes upto a depth of 14 ft. Since the area is low lying and doesn't have drainage facilities, it remains inundated for 3 to 4 months in a year, for almost the entire kharif season. The Diara lands in Bihar constitute an area of 11.59 lakh hectare. The topography of this land is undulating with confused patterns of upland and low land. The Chours is a large tract of land in North Bihar which remains water logged for a variable period and represents a fragile and unstable eco-system. About 4 lakh hectares is chour land with varying depths of water for varying periods of the year.

3.7 **Land erosion and degradation:** A severe problem of the region is that the available land is subjected to heavy soil erosion and degradation

resulting from deforestation and incessant rains in a very short period. This process especially in the North Eastern region is aggravated by the continuation of shifting cultivation which is the single largest factor for the loss of forest cover which ultimately renders the soil unproductive.

3.8 Shifting or 'Jhum' cultivation: The undulating topography, hill slopes and varying altitudes create problems of agricultural production associated with enormous soil erosion and safe disposal and management of high volumes of water in a short time following heavy rainfall. In many cases, varieties suited to low altitude areas do not perform well or are not suitable at all for medium and high altitudes due to lack of cold tolerance. About 1.7 million hectares are under '*jhum*' cultivation. Shifting cultivation, which is part of the ethos of the North East, leads to large scale deforestation and denudation of hill tops and slopes resulting in soil erosion and loss of soil fertility. Continuance of this system of farming offers very little scope for introduction of modern/improved technology.

3.9 Land tenure system/ small operational holdings: Community ownership of land in North East, ownership by the village chief and prevailing land tenure systems often act as a disincentive for sustainable development and maintenance of land for cultivation. In the plain areas, the average holdings are very small and unviable as sustainable economic units. Besides, tenurial relationships do not encourage adoption of technological advances and are often highly inequitable. The success of land reforms in West Bengal is reflected in revitalisation of the agriculture sector and urgently needs to be replicated in other States.

3.10 Acid soil: The acid soils of the region have low availability of phosphorus, which gets fixed on application and thus leading to low response to fertilizers. The soils also have aluminum toxicity to plants. Acid soils are found extensively in the North Eastern region, peninsular India including Bihar

plateau(Jharkhand state), sub-plateau regions of West Bengal, Orissa and Chhatisgarh. The problem of soil acidity needs immediate attention in Eastern India as around 20 Mha is under an advanced stage of land degradation. These soils have good production potential if treated with lime and basic slag, burnt shells and pressed mud.

3.11 Coastal salinity: The problems of coastal saline area are caused by wind erosion, shifting of sand masses and inundation of fields by sea water due to high tides. It is also caused due to continuous submergence of sea water and loss of considerable volume of fresh water into the sea particularly in rainy months and over draft of ground water through pumps and tube-wells, etc.

3.12 Low Productivity: For a variety of reasons, productivity limits in the Eastern and North Eastern regions are generally lower than the national average. Apart from inherent constraints such as topography, holding size, tenurial patterns, etc., farming operations are characterized low input intensity, poor technology transfer and weak post-harvest infrastructure.

3.13 Lack of quality seeds and planting materials: One of the most important causes for low productivity is the poor quality of seeds and plants of improved cultivars. Although large number of nurseries have been established in the region and many seed companies are operative, but there is a shortage of quality seeds and planting material. Mechanisms for assessing quality of seeds and plants is weak and farmers are also unaware about the risk in use of poor quality plants. State Seeds Corporations, where they exist in the region, are in poor health and unable to provide quality seeds. Moreover, quality control and enforcement mechanisms are practically non-existent and testing facilities largely defunct.

3.14 Replacement and rejuvenation: Low seed replacement rates and, in the case of perennial fruits and plantation crops, predominance of old and

senile orchards and poor management lead to low and declining productivity. Senile mango, declining citrus, poorly maintained litchi, and plantation crops which suffer from infestation of insects, pests and diseases and inadequate nutrition are problems which need to be urgently addressed.

3.15 Subsistence cultivation: Both agricultural and horticultural operations in the region are largely subsistence cultivation. Technological advancement has improved the productivity in many parts of the country, but improved inputs, advanced technologies and high tech practices have been adopted in the eastern and North Eastern region on a very limited scale. The situation is accentuated by lack of awareness about technology, poor capacity of farmers to invest and poor credit support coupled with weak infrastructure.

3.16 Post-harvest management: Horticultural crops being highly perishable suffer heavy losses due to poor post harvest management, which makes the investment in these crops risky. In the absence of infrastructure facilities, production of these crops suffer from the crippling uncertainty and instability of market conditions. In view of poor risk bearing capacity of marginal farmers, the productivity is adversely affected. Absence of grading, sorting and packing facilities, storages, pre-cooling and cold-storage infrastructure are a severe constraint particularly with regard to horticultural produce.

3.17 Marketing: Marketing of produce is a major component of the total production system and has a major role to play in making this system viable. As witnessed in the recent past, farmers even in Bihar and parts of Orissa are generating marketable surpluses, but in the absence of marketing infrastructure they are unable to get remunerative prices for their produce. Cooperative marketing is very weak in the Eastern and North Eastern region. The entire marketing system is handled by commission agents. Fruits are mostly auctioned by the orchard owner to pre-harvest contractors resulting in low returns, which do not encourage investment to achieve higher productivity. By and large, the

marketing system is oriented neither to the producer nor consumer, but to the middleman, who earns exploitative margins. Moreover, the long distances between production and consumption centers is also a disincentive to the producer.

3.18 Processing infrastructure: Weak processing infrastructure also contributes towards keeping the production at a low level. High production in season causes supply to be more than the demand and in absence of arrangements for processing, glut situations occur which become a disincentive for production. Wastage levels are considerably high.

3.19 Market intelligence and management capacity: On account of the various constraints prevailing in the region, there is a critical absence of market information, and knowledge of technological advances. Professional and commercial orientation and entrepreneurial capacity is lacking and human resource development is urgently required in all sectors.

3.20 Investment capacity: The high capital cost involved in establishing an orchard or plantation as also setting up of required infrastructure is a major factor and a serious constraint in exploitation of the potential for horticulture in the North East. Variable cost is also high for vegetable and flower cultivation. The situation becomes all the more difficult in view of the large number of small holdings, owned by weaker sections, who have no means to invest, nor can afford the burden of credit even if available. Added to this is the long gestation period of perennial fruits and plantation crops before reaching the economic bearing age. In view of long gestation period, scientific management and high investment credit support is particularly crucial in horticulture sector.

3.21 Dissemination of information: Agricultural Universities and other units of ICAR are operative in the region, but the existing system is not adequate to address the problems of agricultural and horticultural development. The

extension system is also weak. Departments of Agriculture in most of the States do not have adequate manpower and infrastructure to address prevailing problems. Further, they suffer not only from weak extension support in physical terms, but also from absence of a well-tested and adaptable systems for transfer of technology. Absence of such systems create a major credibility gap in the viability of the technology developed at the research institutions, and therefore finds limited application.

3.22 Database: For any planning process aimed at developing a particular sector, an authentic up-to-date database is essential. In the horticulture sector, in particular, both at national as well as regional level, the database is very poor. Unless the data base is made stronger and broader in its coverage, long term planning for development of agriculture and allied sectors will be difficult and unrealistic. In the North Eastern region in general, a comprehensive and reliable database for agriculture, horticulture, animal husbandry and fisheries is an urgent necessity.

3.23 Risk Management: While all the Eastern States have opted for the National Agricultural Insurance Scheme, only Sikkim and Meghalaya, among the North Eastern States have opted for insurance cover. Risk cover in horticulture crops is non-existent, although crops like onion and potato are covered under National Agriculture Insurance Scheme. In the absence of yield data, it would be difficult to cover other horticultural crops. There is a need to cover risk in case of horticultural crops on a different basis, perhaps on potential production coverage instead of average yield. This would encourage higher investment to achieve higher productivity.

3.24 Locational disadvantage of North Eastern States: The North-Eastern region shares only two percent of its border with the mainland of the country and the balance 98% is an international border with Bangladesh, Myanmar, China and Bhutan. The region has an external frontier of over 4500

km. with Bhutan, China, Myanmar and Bangladesh, but no more than a slender 22 km. connection with the Indian heartland through the tenuous Siliguri corridor. This alone is a cause of severe market disruption, socio-economic and cultural distancing and retardation. On the other hand, it is natural and necessary for the region to look to neighbouring countries for markets, as well as exports through Chittagong port of Bangladesh. Promotion of border trade is likely to create opportunities for the people to earn their livelihood, simultaneously providing greater avenues for private investment in infrastructure.

3.25 NERAMAC: The Government of India had set up the North-Eastern Regional Agricultural Marketing Corporation (NERAMAC) at Guwahati, under the control of Department of Food Processing, to catalyze and coordinate operations for marketing the produce of the North Eastern region. However, neither has much work been done so far, nor is NERAMAC presently in a state to meet the challenge, in view of its unsound financial and technical capability.

3.26 Animal Husbandry: The same constraints that face the agriculture and horticulture sectors also confront the animal husbandry sector: low productivity of animals, inadequate veterinary services, non-availability of improved breeds, shortage of feed and fodder, poor dissemination of technical know-how, absence of backward and forward linkages for processing and marketing. Despite the high potential of livestock rearing in the Eastern and North Eastern regions and for the development of piggery and small ruminants in the North East, the opportunities are largely untapped.

3.27 Fisheries: In this sector too, similar constraints hold back development. Both the Eastern and North Eastern regions hold excellent potential for fisheries but, ironically, are net importers of fish. Here again it is necessary to ensure that the benefits of research and technological advancements reach the producers, along with adequate credit and other support, as well as cold storage facilities, processing and marketing infrastructure.

3.28 **Credit:** While credit availability per hectare in Kerala is more than Rs. 5,000, in Bihar it is only Rs. 50 and in the North Eastern States about Rs. 25. The lack of institutional credit is a severe constraint to development. While, in the rest of the country a significant proportion of agricultural credit is provided by cooperative institutions, in the Eastern, and, more particularly, in the North Eastern region, the cooperative credit structure is in a moribund state. Commercial banks and RRBs on the other hand, are largely urban and semi-urban, functioning mainly as deposit mobilization centers. As a result, the avenues for credit in agriculture and its allied sectors are very limited, with moneylenders playing the key role. It is also significant that the recovery percentage in the region is barely 30%, consequently hampering the flow of ground level credit. The credit – deposit ratio also averages barely 30%.

3.29 **Cooperative Structure:** The cooperative structure in the Eastern and North Eastern regions is in varying stages of sickness and the true spirit of cooperativism is slowly disappearing. Lack of cooperative leadership and appreciation of the principles of cooperativism, inadequate assistance and support from the State, have rendered the cooperative sector largely defunct. This has had a particularly adverse affect on the availability of agricultural credit, supply of inputs and marketing.

3.30 **Vulnerability to Natural Calamities:** Both the Eastern and North Eastern regions are highly susceptible to flood and cyclone damage. While Bihar faces recurrent floods on account of overflowing streams and rivers, West Bengal and Orissa regularly face the threat of cyclones and tidal waves in the coastal areas. In the North Eastern region too, natural calamities occur at regular frequency. This necessitates not only prevention measures, to the extent possible, but mitigation, relief and rehabilitation operations.

3.31 **Cash flow constraint:** The States of both the North Eastern and Eastern region are severely constrained by the acute shortage of financial

resources. While the States find it increasingly difficult to raise their own resources, they depend to a large extent on the Central Government for developmental funding. Ironically, however, due to a variety of reasons, a significant portion of Central funds remain unspent. Indeed, despite earmarking of 10% of Plan allocations exclusively for the North Eastern region, the experience has been that only about half this amount is actually released to the States. The balance of earmarked funds are credited to the Non Lapseable Pool, from which the North Eastern States can draw resources against proposals drawn up by them. Few of these proposals, however, relate to the agriculture sector which, in effect, implies that the initial unutilized allocations of the sector are spent elsewhere.

3.32 Limited capacity for resource utilization: As mentioned in the preceding para, State Governments in the Eastern and North Eastern region are, by and large, unable to spend even the limited resources made available by the Government of India for developmental programmes. This is partly due to delays in transferring the funds to implementing agencies, who in turn have limited capacity to utilize the resources effectively. It is in this background that several programmes of the Central Government in various sectors are being implemented through semi-autonomous registered Societies, NGOs, etc.

3.33 Absence of Long-Term Perspective and Vision: Possibly due to historical reasons, a long-term perspective and vision for development of agriculture and allied sectors in the Eastern and North Eastern regions is sadly missing. The general attitude of the States has been to look toward the Central Government for assistance and amongst producers to seek subsidies from the State Governments. On the part of Central planners, there has been a lack of appreciation of the characteristic identity, needs and notifications of the region. This has generally prevented the development of a vibrant sustainable system based on new technologies and entrepreneurial spirit.

4. VISION AND APPROACH TO DEVELOPMENT

4.1 The challenge before the country today is of providing food security and enhancing the quality of life of all citizens by making available employment, enhanced income and better livelihood opportunities. The Eastern and North Eastern regions of the country, in particular, are characterized by high incidence of poverty, social and economic inequities which are largely the consequence of regional and other imbalances in the overall milieu of the people inhabiting the area. The enormous potential of the region in agriculture, horticulture, animal husbandry and fisheries is contrasted by the low levels of productivity in the region which are generally below the national average. The emphasis in the Tenth Plan with regard to the Eastern and North Eastern regions should, therefore, be on facilitating the utilization of the latent potential and bridging yield gaps so as to impact on overall human development aimed at improving the quality of life, providing multiple livelihood opportunities contributing to income enhancement, extending improved health, nutrition and higher levels of literacy and education, accompanied by empowerment of the people leading to evolution of a better and more equitable social structure. A holistic and long-term approach is needed to redress the adversities and imbalances that exist today and to bring about comprehensive change in the human development graph of the region.

In the context of the comparative backwardness of the Eastern and North Eastern Regions and the opportunities that they concomitantly afford, this part of the country must necessarily constitute the central focus of national agricultural planning in the coming decades. It is significant that during the past few years there has been a remarkable acceleration in the crop output of West Bengal and Assam principally by utilizing their plentiful and under exploited ground water resources. This has underscored the fact that a quantum increase in productivity can be attained in the region simply by tapping abundant existing resources. The gap between potential and actual yield, which can be bridged

through easily accessible technologies, reflects the capacity of this region to become the granary of the future. Consequently, the strategy for national agricultural development in the Tenth and subsequent Plans should necessarily focus primarily on the Eastern and North Eastern regions in order to breach the plateau on which agricultural production presently seems to be stagnating. The scenario of untapped potential is equally evident in the spheres of horticulture, animal husbandry and fisheries. A holistic approach to development of the region, covering linkages from research and development to agro-processing and marketing, will bring a significant shift in the human development paradigm of the region.

4.2 The vision for agricultural development in Eastern and North Eastern India will, therefore, comprise of the following elements:-

4.2.1 Providing multiple livelihood opportunities: Jobs and livelihoods must be the bottom line of our economic and development policies, and the well-being and welfare of the farmer should lie at the core of agricultural strategies and programmes. As a predominantly agricultural region characterized by very small unviable land holdings, income enhancement can be effected by providing multiple livelihood opportunities and by increasing non-agricultural employment through utilization of local strengths and resources in horticulture, floriculture, cultivation of herbs and medicinal plants, sericulture, goat rearing, dairying and milk production, poultry, piggery, and fisheries, combined with primary value addition at the household level. Given the availability of micro-credit and market opportunities, these activities will result in a sustainable and vibrant local economy.

4.2.2 Sustainable agricultural development through farming systems approach: It is said that in the case of most crops, the present average yield is just one-third of what can be achieved even with currently available technology. A productivity revolution in farming can, therefore, be brought about by closing the gap between potential and actual outputs in most farming systems. An

integrated approach is necessary to remove the technological, infrastructural and policy constraints responsible for the productivity gap. Reducing the cost of production through eco-technologies and increasing income through efficient production and post-harvest technology will enhance opportunities for skilled employment and farm income. Precision farming methods must be adopted to attain optimum income and yield per drop of water and per unit of land and time. The agro-ecological potential of every village should be utilized in an ecologically and economically optimal manner. Systematic efforts should be undertaken in each agro-climatic zone to identify and remove the constraints responsible for prevailing yields gaps and to develop appropriate field-level interventions. The farming systems approach, combining crop and animal husbandry, horticulture and agro-forestry, will ensure the most efficient use of given soil, water and climatic conditions.

4.2.3 Efficient natural resource management: Conservation and enhancement of soil and water resources, as well as forests and bio-diversity, through an integrated package are essential from the point of view of both environmental and economic sustainability. Water-harvesting, watershed development and economic and efficient water use can help to enhance productivity and income considerably. Conjunctive use of different sources of water should be the rule rather than the exception. Regional imbalances in agricultural development are largely based on availability of assured irrigation. Especially in Eastern India, where water is plentiful, a significant break-through is achievable through an appropriate package of technology, techno-infrastructure and services, besides pricing and marketing policies. In the North Eastern region, efficient natural resource management entails a combination of agro-forestry, horticulture, integrated crop and animal husbandry. An integrated strategy can provide for optimum commercial gains from given situations while protecting the land from degradation and depletion. It may not be possible to eradicate the practice of 'jhuming' in the North East, but it could be rendered less destructive, or even productive as demonstrated in Nagaland. Community

management of resources is an integral part of effective conservation and efficient management. Appropriate institutions need to be promoted and sustained to ensure optimum use of available natural resources. In the North Eastern region, in particular, the rich bio-diversity needs to be protected through a judicious combination of traditional farming and conservation activities. For sustainable agricultural operations which prevent environmental damage, it will be necessary to ensure that the benefits of commercial and economic exploitation of local resources accrue to the community in proportion to their efforts towards preservation and conservation of their environment.

4.2.4 Strengthening capital formation in the agricultural sector:

Capital formation in the agricultural sector has declined sharply in the last decade. The need for stepping up investment in this area has been highlighted by several studies. While a significant proportion of the investment would be from the private sector, it cannot be denied that public sector investment needs to be raised considerably especially in the capital starved Eastern and North Eastern regions. Private sector investment will inevitably follow enhanced levels of public spending. The prime areas for investment would be:-

- development and improvement of land, as well as efficient water use technologies;
- development of employment opportunities in the rural sector through strengthening of rural industry;
- establishment of primary processing facilities for value addition of commodities in rural areas;
- availability of cheap and timely credit for agricultural operations;
- provision of marketing infrastructure in order to provide better returns to the producer;
- expansion of rural connectivity in terms of road network and communications;
- development post harvest and storage infrastructure.

4.2.5 Converting “backwardness” to comparative advantage: The North Eastern region, in particular, is characterized by certain features which may be seen as major constraints to development, but which can be used to the advantage of the region in the globalised economic scenario. The low input intensity of agriculture of the region makes it ideally suited for organic cultivation. By capitalizing on the organic and eco-friendly nature of agricultural and horticultural produce of the region, significant gains may be achieved in the burgeoning market for organic products. In the field of exports, in particular, a major break-through can be achieved through organic products. The comparative advantage of the region can be exploited in the form of eco-foods produced through small scale organic farming enterprises, medicinal plants and green health products, feed grain and livestock products, plantation products and so on. The North Eastern region shares only 2 per cent of its border with the main land, while 98 per cent is an international border with neighbouring countries. This is often viewed as a handicap, but it also provides remarkable opportunities for border trade and export.

4.2.6 Stimulating new employment opportunities: In the coming decade, it will be important to make farming and other rural occupations both intellectually stimulating and economically rewarding with the purpose of attracting and retaining educated youth in rural areas. With the high rate of literacy in the North Eastern region, and growing literacy levels elsewhere, special efforts are required to provide opportunities for new employment in rural areas in order to obviate a host of socio-economic problems. Advances in information technology provide opportunities for educated youth to establish ‘knowledge centers’ that can cater to location-specific information needs. Gainful employment, as well as essential extension services, can be provided through a network of agri-clinics and agri-business centers in rural areas. Agricultural consultancy is likely to acquire increasing importance in the context of precision farming. Opportunities for new employment would also include non-traditional

occupations like sericulture, floriculture and aquaculture, the production of eco-food, 'bio-logical software' for sustainable agriculture like bio-fertilizers bio-pesticides and vermi-culture, bio-processing, health food, herbal medicine, recycling of solid and liquid wastes, machinery for agriculture and agro-processing, etc.

4.2.7 Harnessing the gains of information technology and bio-

technology: The network of knowledge centers or agri-clinics and agri-business centers (mentioned above) will provide location and farming systems specific advice on areas related to meteorological, management and marketing factors and will result in a restructuring and re-orientation of extension services. The knowledge revolution, particularly in the areas of information technology and biotechnology must be harnessed to an efficient and eco-sensitive precision farming system. The challenge in the coming years will be to provide all producers access to information and new technologies that will enable higher productivity and sustainable livelihoods.

4.2.8 Decentralization and micro-planning:

It has been repeatedly shown that in order to ensure optimum delivery of services and programmes, a decentralized and participatory system is the most effective. Creating a sense of ownership among the participants and beneficiaries, based on micro-planning and local need assessment, is necessary to deliver results. The focus, therefore, should be on participative planning, participatory management, establishment of micro-enterprises, support for self-help groups, extension of micro-credit and promotion of local accountability. A conscious thrust to increase participation rates of women should be adopted for enhancing the success and sustainability of programmes. Moreover, innovative new mechanisms for promotion, delivery and coordination of services in agriculture and related sectors need to be developed, possibly on the lines of decentralized bodies such as Small Farmers Agri-Business Consortia.

4.2.9 Promoting Marketing and Value Addition: One of the major constraints in the way of agricultural development of the North Eastern and Eastern regions is the weak post-harvest and marketing infrastructure and the low level of value added agro-food production. This has resulted in farming being largely uneconomical with major gains being cornered by a small group of traders. The Tenth Plan should, therefore, provide special focus to strengthening marketing and value addition infrastructure in the region. A modern marketing system for agricultural and horticultural produce, animal products, fish and agro-forestry will have to be established based on post harvest handling, grading, packaging, processing, storage and transport with adequate credit support. This aspect has to be assigned the top-most priority in order to meet the needs of each specific area. The strengthening of market structure will also entail review of existing legislation and removal of redundant restrictions on agricultural trade, creation of a comprehensive database use of information technology, e-commerce and development of a market intelligence system.

4.3 APPROACH TO DEVELOPMENT

It is evident that while the Eastern and North Eastern regions are rich in natural and human resources, the benefits of developmental planning in the last five decades have largely by-passed this part of the country. It is also evident that the Tenth and subsequent Plans must necessarily focus on agricultural and human development in the Eastern and North Eastern region. This will entail a shift in the planning paradigm, taking into account the specific conditions and heterogeneity of the region. Uniform policy prescriptions should be avoided, while local initiatives and institutions need to be fostered. In the context of Eastern and North Eastern India, the concept “think, plan and act locally, and support nationally” would be an apt basis for policy formulation. The approach to agricultural development in the region should, therefore, be based on the following components:-

4.3.1 Eco-Regional Technology Missions: The concept of Eco-Regional Technology Missions is based on the blending of traditional wisdom and practices with frontier technologies such as bio technology, information technology, space technology and renewable energy technologies. Eco-Regional Technology Missions will aim to increase per capita income through intensive integrated farming systems rooted in the principles of economics, employment generation, ecology, gender and social equity. The approach will link ecological security of the region with the livelihood security of the people in a mutually reinforcing manner, promote peoples initiatives in managing common properties like land, water and forests, create an economic stake in conservation, and strengthen community institutions and initiatives.

Technology Missions have proved their utility in the past. The Technology Mission approach involves concurrent, adequate and appropriate attention to every link in the production – consumption chain. To make a breakthrough in agricultural production and rural prosperity in the Eastern and North Eastern region, a holistic approach will be needed and the numerous on-going programmes in the fields of agriculture and rural development will have to be brought together in the form of an Eco-Regional Technology Mission. This will enable integrated attention to production and post-harvest technologies and to on-farm and off-farm employment, and achieve vertical and horizontal integration among different activities. The approach to development in the Tenth Plan should, therefore, be based on Eco-Regional Technology Missions for the North Eastern and Eastern regions. The major elements of Eco-Regional Technology Missions are listed below:-

- Identification of appropriate crop, livestock, tree, animal and fish components of the farming system on the basis of local resources linked to market requirements.
- Soil conservation and health care and sustainable land use, rainwater harvesting and conservation, watershed development, ground water

utilization, water management and conjunctive use of rain and ground water.

- Crop and pest management involving integrated nutrient management and integrated pest management systems.
- Energy management based on optimum use of available resources.
- Post-harvest management combining the most appropriate technologies for threshing, sorting, packing, storage, processing and value addition.
- Use of latest information and knowledge, development of skills and management capacity, and empowerment of producers.

The recently introduced 'Technology Mission for Integrated Development of Horticulture in the North Eastern Region' reflects the integrated approach needed to maximize economic gains from the horticultural potential of the region. This initiative needs to be built upon in the Tenth Plan by strengthening the aspects relating to conservation and farming systems approach.

As in the case of the North Eastern region, the eco-regional technology mission approach should be the platform for development of the Eastern Region in the Tenth Plan. The Scheme for On-farm Water Management for Eastern India, that is presently under formulation, is inadequate both in its scope and its vision. The Scheme would need to be completely reworked in order to encompass the essential elements of the eco-regional technology mission approach.

A brief analysis of the problems and possible solutions in some of the eco-systems of the region is given in Appendix-VIII.

4.3.2 Rice-based farming systems: The Gangetic plains of Eastern U.P., Bihar, West Bengal and the Brahmaputra and Barak Valley of Assam perennially experience the hazard of water logging and flooding. These areas, also recognized as the most agriculturally improved production centres of this region, are mainly dominated by rice cultivation.

Rice based farming systems, involving pisci-culture and rearing of animals/small ruminants, poultry, piggery and goat should be introduced as an integral part of the integrated farming system. With the advent of WTO regime and opening of agriculture to external competition, the prices of rice and other cereal crops may experience downward market trends. This calls for diversification of agriculture for better economic gains to farmers by exploiting the abundant water resources and climate. Research on farming systems approach in the Eastern region, having a predominance of small farmers, should be strengthened to come up with the best possible alternatives for positive economic benefits.

Sporadic, market driven developmental efforts are seen in many places through introduction of sweet oranges in Midnapur district of West Bengal, growing of flowers like marigold, rose, tuber rose, gladiolus, jasmine in Midnapur and Hooghly districts of West Bengal. These are some market oriented viable farming systems for the Indo-Gangetic plain areas of Eastern region. However, this needs to be studied and viable financial and institutional arrangements, including marketing facilities, post harvest management need to be incorporated for large scale adoption of these alternative systems of diversified agriculture. Other examples of substitution of rice cultivation by market oriented entrepreneurs are groundnut cultivation in Jajpur, Kendrapara and Balasore districts of Orissa, growing of winter season vegetables like cabbage, cauliflower, french bean, carrot in the coastal districts of Bhubneshwar and Cuttack in Orissa. Water logging is a difficult problem in all the plain areas of Eastern region and persist as wet land ecologies. Such land can be economically utilized for growing suitable crops like Makhana in Dharbhanga District, Bihar and water chestnut in Eastern U.P. Similarly Swamp Taro in West Bengal, and Singara (paniphal) can be popularized, outside traditional growing areas.

4.3.3 Utilization of rice-fallow areas: From the land use classifications in the Eastern region, it is evident that an extensive area of cultivable waste, permanent pastures, other fallows, current fallows are available in most of the States. Moreover, in most of the cultivated areas where assured irrigation facilities are not available, generally a single crop of rice/ maize/kharif/ pulses/oilseeds are taken. The annual area thus available after Kharif crop under this category of land is very high as more than 24 million hectare area is under rice cultivation in the states of Assam, West Bengal, Orissa, Bihar and Eastern U.P. The cropping pattern in this type of land is rice followed by fallow. No cultivation is undertaken after rainy season because of lack of location specific agro technologies, as well as of stray cattle menace. The residual moisture content, however, in this type of land is high.

In the Rabi season, the production and productivity of crops is generally higher because of better water control, abundant sun shine and lack of insect and pests. So if the areas are identified and systematic interventions are taken up on a catchment scale of 100-200 ha., a large area in Orissa, Jharkhand, Chattisgarh, Assam, Manipur and some of the undulating upland areas of West Bengal, Bihar, Meghalaya, Arunachal Pradesh, Nagaland and Mizoram can be brought under oilseed and pulses/vegetable crops which do not require large amount of water. Appendix 9 gives a rough estimate of per hectare investment and return on various activities.

4.3.4 Location-specific diversified farming systems: The large expanse of Tal, Diara and Chauras and Beels in Bihar, West Bengal, Assam, as well as U.P. requires targeted solutions. A sizeable population lives in this area and is fully dependent on agriculture which relies predominantly on traditional practices for water logged wet lands, resulting in low levels of output. The Tal area in Bihar extends over some 1000 sq. km. and the diara is estimated to cover 11.59 lakhs hectares. The topography of this land is undulating, without drainage facilities and presents confused patterns of upland and low land.

With the advent of modern technologies, these areas can be put under profitable aquatic farming systems on watershed approach along with necessary infrastructure development such as roads, electricity, supplemental irrigation through shallow tube wells, marketing facilities, etc.

Fish farming, with vegetable cultivation and other market oriented endeavours like Makhana, Singara(Panifal), Swamp Taro, etc., can be a viable proposition on catchment scale encompassing one or two villages. There is an urgent need to take up such model developmental work based on farming systems approach in each of the wet land areas of Bihar, West Bengal and Assam.

In the whole of the North Eastern region, very good locations are available on both sides of large systems of streams and nallahs for growth of fishery based systems with year round growth of vegetables. This is already quite popular in some areas in Meghalaya, Assam, Nagaland and Manipur on the sides of highways. Special research and developmental efforts are needed to typify various hydrological, agricultural and cost-benefit parameters, along with post harvest management and marketing systems.

4.3.5 On-farm water management: Because of the topography, abundant rainfall and extensive network of streams and rivers, there is huge ground water potential in all the States of Eastern and North Eastern region, except the eastern plateau and eastern ghats eco-region. Almost the whole of the Eastern region is categorized as “white”, with ample scope of ground water exploitation and possibility of multiple cropping. Ground water exploitation is very meager in all the districts of Orissa, Bihar, Jharkhand and Chattisgarh region where a considerable area is available as rice-fallow.

A report of the Reserve Bank of India on agricultural development of Eastern region, emphatically argues that ground water exploitation holds the key to natural resource management and for bringing economic benefits through agricultural operations. Faster economic growth for increasing production and

productivity of agricultural crops can be attained by tapping surface flow by minor irrigation systems, and through privately financed shallow tube wells/tubewells operated systems.

Under these conditions, emphasis should be on creation of irrigation potential within a short time frame by encouraging farmers to instal shallow tube wells and lift irrigation schemes through provision of easy credit and back-ended subsidy. Awareness development should be taken up to emphasize the potential of on-farm water management. Simultaneously, efforts should be made to organize farmers in self-help groups to take the benefit of credit and to increase cropping intensity and to diversify to vegetable/flower/fruit based agricultural production systems.

4.3.6 Sustainable Agro-forestry systems: Agroforestry has attained global recognition as an economic means of sustained income from the land resource, which can also arrest land degradation and serve to maintain the ecological balance. There are many agroforestry systems especially for the temperate wet regions, hill regions, Indo-Gangetic alluvial plains and the transitional zones of the Eastern region. The silvi-horti model of *Casuarina equisetifolia* (10x2 m spacing) combined with fruit species (10x6 m) such as *Psidium guajava*, *Embllica officinalis* and *Zizyphus mauritiana* indicate excellent growth and fruit yield. Agri-silvi model of *C. equisetifolia* (7x7 m) combined with agricultural crops such as wheat (var. Sonalika) and paddy show considerable increase in crop yield within 5 years of establishment of the system. Similarly *Madhuca indica* combined with wheat and paddy may be adopted by Chhotanagpur farmers. Similarly *Tectoma grandis* introduced along with wheat and paddy is advocated.

In the hilly zones of the Eastern region, agri-silvi-horticulture systems involving sapota, teak plantation and agriculture crops seems to be promising. Similarly in the horti-silvi pastoral system of *Casuarina* or *Leucaena* in interspace of sapota can bring substantial income to farmers. In transitional

zones, teak based agroforestry system involving growing of field crops (Sorghum, Chilli and Groundnut) promises good results.

To support sustainable and commercially viable agro-forestry systems special focus should be placed on:

- availability of quality planting material;
- training and capacity building on specifies tree-crop interaction and economics of agroforestry systems;
- extension efforts to popularize agroforestry as a means of income generation;
- mobilisation of joint/community efforts, development of cooperatives, creation of Self-Help Groups;
- provsion of micro-credit;
- provision of linkages for post-harvest management and marketing.

4.3.7 Organic farming for sustainable production: It is reported that production of 1 t/ha of cereal grain means removal from the field of about 20kg N/ha and about 4 kg P/ha. In fact, nearly 50% gain in food grain productivity seen in recent times has come through inorganic fertilizer alone. However, in recent years, long term sustainability of agricultural productivity and environmental safety on its use are being questioned. It is a well documented that fertiliser N use efficiency seldom exceeds 40 % under low land and 60 % under upland conditions. In case of P and micronutrient fertilizers, the efficiency hardly exceeds 20 and 2% respectively even in the best-managed package of practices. From the analysis of the fertilizer use statistics (1999-2000), the fertilizer use in all the North Eastern states are less than 20 kg/year/ha except for Assam (31 kg), Manipur (92 kg). From this it is evident, that farmers are accustomed to cultivating the land with traditional practices using mostly organic manures like farm-yard manure, crop residue etc.

In view of the inherent nature of farming practices and soils of the Eastern and North Eastern regions, there is enormous scope of adopting organic farming systems with special emphasis on the following points:

- **Rural and urban composts** : The potential of rural and urban composts in India is estimated to be utilized to the extent of less than 30%. Less than 50% of the manurial potential of the livestock population is utilized in crop production and a large proportion is lost as fuel and droppings in non-agricultural lands.
- **Crop residue**: About 400 million tonnes of crop residues are produced in the country. The major portion of the residues is used as animal feed and about 33% of these residues are available for direct use as compost and manure in various agro-climatic conditions.
- **Legumes**: Integrated use of green manure and chemical fertilizers can save 50 to 75% of N fertilizers in rice. The problem with green manure crops is that they compete with cash crops for space, time, water and other inputs. Moreover, they are grown when evapo-transpiration rates are very high in summer and water is scarce. This makes it difficult to grow them in many areas especially those growing rainfed rice. Fitting legumes into cropping systems is a task of challenging complexity.
- **Biofertiliser**. Inoculation of *Rhizobium*, *Azotobactor* and *Azospirillum* substitute, 19-22 and 20 Kg N ha respectively. BGA applied 10Kg/ha gave a saving of 20-30 kg N/ha and Azolla at the rate of 6-12t/ha had an N equivalent of 3-4 kg/t. Even then, there is low level of acceptance by farmers because of low visible impact of biofertilizers. There are several constraints to the effective utilization and popularization of bio-fertilizers. Biological nature of biofertilisers and their susceptibility to abiotic factors is responsible for highly inconsistent performance. Many micro organisms

also have a short shelf-life and there is a lack of suitable carrier material for restoration and longevity in actual field conditions. Strict quality control measures, efficient extension activity through demonstration, and creating awareness among farmers are other requirements for full exploitation of bio-fertilizers.

The North-Eastern region has to be vested with a Unique Selling Proposition (USP) by labelling various products in the region especially in the agriculture and related sectors as organically produced or eco-friendly through proper publicity campaigns in which national level organisations need to play a major role. To obtain greater and easier acceptance of such organically grown products in developed country markets such as European Union and USA, certification by designated agencies in these countries may also be obtained. SFAC and NHB can perhaps play a proactive role in this regard to assist APEDA.

4.3.8 Bio-villages: The North Eastern region needs an integrated strategy for sustainable and equitable utilization of its natural resources and bio-diversity and for linking conservation and commercialization in a mutually reinforcing manner. The inherent strength of the region in this sphere has not been sufficiently tapped and major gains may be had through an integrated strategy. Bio-villages will provide opportunities for production and marketing of organic products, health foods, eco- and bio-goods, herbal medicines, etc., for the growing market for these commodities in India and abroad. The elements of this approach would be based on

- Revitalization of conservation traditions of the tribal and rural population, as well as traditional knowledge of herbal medicine and health cures.
- Establishment of herbal nurseries and genetic gardens, eco-friendly and organic agro-forests.
- Linking conservation and commercialization through agro-forestry and mechanisms of cultivation such as land leasing

and contract cultivation for production of economically valuable plants, such as medicinal plants and plantation crops.

Bio-villages should be organized so that the food, fodder, fuel wood, medicine and other livelihood needs of local communities can be met without causing harm to local biodiversity. By blending traditional wisdom with frontier technologies, optimum commercial benefits can flow to the local community, while conservation needs are safeguarded.

4.3.9 Eco-Friendly “Jhuming”: The practice of Jhuming in the North Eastern region is so deeply entrenched that it would be almost impossible, if not impracticable, to break the tradition. The solution, therefore, appears to lie in making Jhuming less destructive on the one hand, and more commercially beneficial to its practitioners on the other. The experience of NEPED in Nagaland shows that eco-friendly ‘Jhuming’ is possible. By combining this approach with the bio-village concept (discussed above) an appropriate balance between conservation and commercialization, traditional wisdom and modern technologies can be achieved. The extension of this form of Jhuming may require modifications in existing Laws accompanied by formal empowerment of communities. The formation of Joint Ventures between corporate bodies, the State Government and the local community, whose rights in land may be their investment or share-holding, could be a viable model.

4.3.10 Special thrust on Fruits and Vegetables: Production of fruits and vegetables in the North-Eastern region is estimated to be around 25 lakh tones. A variety of fruits are produced, such as pineapples, oranges, lemons and limes, bananas, mangoes, guavas, litchi, papaya, jackfruits, apples, pears, plums and peaches. Among the vegetables produced, tomato, potato, cabbage, sweet potato, tapioca, squash, colocasia, brinjal, onions and cauliflower are important. Production of fruits and vegetables is spread over almost all the States.

Although the concerned State Governments have taken initiatives in establishing small processing-cum-demonstration centres taking advantage of the resource position in the region, there has been no significant contribution to the development of fruit and vegetable processing industry. Successful development of the fruit and vegetable processing industry in the region calls for significant increase in the production of fruits and vegetables so as to facilitate establishment of processing units on a viable commercial scale. Scale of operations of a unit assumes importance if price competitiveness is to be achieved. Further in order to ensure that the processing units function almost round the year, a variety of processed items need to be produced in keeping with the seasonal availability of fruits and vegetables. The "Technology Mission for Integrated Development of Horticulture in North Eastern Region" will address these problems. Another aspect that needs to be given due recognition in planning and implementation of various schemes is the essentiality of giving export-orientation right from raw-material stage. In the case of fruits and vegetables particularly, the varietal requirements for marketing in fresh form and for processing have to be given utmost importance if price competitiveness is to be achieved.

The "Technology Mission for Integrated Development of Horticulture in North Eastern Region" and the State Governments should not only strengthen the present efforts in bringing in new areas under cultivation but also augment yields per hectare by encouraging farmers to adopt scientific methods of cultivation, to produce export-oriented crops. The Technology Mission and the State Governments should also encourage large scale farming for undertaking export-oriented production, perhaps through land leasing and contractual arrangements and participation of the Corporate Sector. Adoption of the latest technologies for harvesting, post-harvest handling, storage, transportation etc., should be supported through credit-linked Schemes. This is vital for arresting wastage and to ensure remunerative returns to the growers. Marketing of fruits

and vegetables both in fresh and processed form has to be undertaken and/or assisted by NERAMAC, NAFED, TRIFED, SFAC, etc.

4.3.11 Prospects for Floriculture: The North-Eastern region has great potential to emerge as the major supplier of floricultural products especially orchids and cut-flowers. This potential, however, largely remains untapped for want of private initiative. While APEDA is promoting Bangalore, Delhi, Pune and Hyderabad as potential export centres, not much attention has been paid to exploit the potential of the North Eastern region. Research and development, extension and training efforts are required, besides provision of quality inputs and infrastructure. National Horticulture Board (NHB), Small Farmers' Agri-Business Consortium (SFAC), and Agricultural and Processed Food Products Export Development Authority (APEDA) should jointly take up the responsibility of developing the North-Eastern region as the orchid region to supply to the global markets. The APEDA may in collaboration with the Governments of Sikkim and Arunachal Pradesh and the North-Eastern Council establish Orchid Auction Centres at Itanagar and in Sikkim so that the cultivators are not put to any hardship in marketing their produce. It is also necessary to create cold storage facility exclusively for orchids in the production centres as also near the Airports. Before the setting up of an Auction Centre, it is necessary to ensure that private enterprise would come forward to undertake cultivation of orchids on a large scale, drawing assistance and expertise from NHB, SFAC, and APEDA.

4.3.12 Targeted Strategy for Medicinal & Aromatic Plants: Out of nearly 4000 species of plants in the country that have been identified to have medicinal value, only about 20 to 30 species are being cultivated. These species are to be protected from over exploitation and the resultant problems. Sustainable production of selected medicinal plants has to be promoted on a commercial scale and those plants which are not amenable to commercial farming should be conserved in their natural ecosystem for regulated utilization. A mission mode approach needs to be adopted for developing the sector.

In order to position the medicinal plants sector on a high trajectory growth path, a comprehensive action plan covering all linkages from research and development of planting materials, cultivation, post harvest technology, processing, manufacturing, research, patenting and marketing is necessary. In view of a very large number of medicinal plants in India, favoured action on a few short listed plants should be initiated. Short listing of such plants has been carried out taking into account the economic nature of the plants, volume of domestic and export demand, the endangered nature of the plant and documented use in traditional systems of medicines. A long term action plan should be prepared and implemented over a 20 year time frame. In the short-term, the following seven plants require concentrated attention:

- Aloe vera (Ghrita Kuman)
- Bacopa monnien (Brahmi)
- Centella asiatica (Mandookpam, Gotu Kola)
- Rauwolfia serpentina (Sarpagandha)
- Catharanthus roseus (Periwinkle)
- Taxus baccata/Taxus wallichiana (Himalyan Yew)
- Artemisia annua

To fully exploit the potential of each of these 7 plants, 'Model Activities' which include preparation of plant specific CD-ROM, cultivation protocols, post-harvest protocols, clinical trials and formation of National Level Association should be initiated. Action is also required towards selecting locations for plantations, research in high yielding and short duration varieties, development of nurseries, training and extension to farmers, introducing and encouraging new technologies like tissue culture, community level processing, marketing through regulated markets, standardization and grading, training of functionaries and intermediaries from traders to customs officers, infrastructure development, provision of fiscal incentives, etc. Creation of a database on medicinal and aromatic plants is also urgently needed. The involvement of NGOs, the newly established Medicinal Plants Board and Industry Associations in all these activities should be explored.

4.3.13 Development of Animal Husbandry: Livestock and dairy development programmes have received scant importance in the Eastern and North Eastern regions. By and large, the benefits of 'Operation Flood' have also not reached this region, perhaps due to the fact that this is not a major occupation of the inhabitants. However, in Bihar, Orissa, Chhatisgarh and West Bengal, the potential for dairy development is substantial. The rest of the region, particularly, the North East, due to reasons of geography and tradition, is best suited for development of mono-gastric animals, backyard poultry and piggery. Rearing of small ruminants also has great potential in this region. The critical factor, however, will be an efficient delivery and marketing system for reaching consumption centers. An integrated programme is required for promotion of animal husbandry related occupations in the context of the farming systems approach, covering of linkages from animal breeding and animal health to procurement of produce, processing, transportation and marketing.

An important fact to be borne in mind with regard to development programmes in the North Eastern region is that compartmentalization within States should be avoided for reasons of economies of scale. An original approach needs to be adopted and common infrastructure created with linkages in all the States. In view of the importance of development of the animal husbandry sector in the North East, Government sponsored infrastructure would need to be created either through the North Eastern Council or independently. It may be necessary to set up a Livestock Development Agency/Corporation for the region with equity participation from the Stake-holders. The proposed organization may be modeled on the lines of National Dairy Development Board with full autonomy and managed by professionals with the following mandate:

- Supply of essential inputs for livestock development, in terms of liquid nitrogen, frozen semen, straws, feed and fodder etc;

- production and supply of piglets/sows, hatching eggs, poultry layers and broilers, and supply to State level hatcheries;
- establishment of a marketing network and provision of credit at reasonable rates;
- provision of technical inputs for HRD, extension and training programmes.

It has been observed that the State Governments of this region have created large infrastructure in terms of cattle breeding farms, hatcheries, liquid nitrogen plants, semen banks etc. without an effective delivery system. These assets may be transferred to the proposed Corporation/Authority, so as to enable optimum utilisation of resources. The proposed body will initially have to be provided a corpus fund by the Central Government with a mandate that it should achieve self-sufficiency in a given time frame.

4.3.14 Potential for Fisheries: Keeping in view the vast and varied aquatic resources available in the region for fish production, greater attention is required for both utilization of the resources and fish yield optimization from them. The present fish production of the region of about 23 lakh tons is just sufficient to provide about 6 kg per capital of fish to its present population against the standard nutritional requirement of 11 kg per capita. To provide the same, the region needs 4 lakh tons of fish for its populace. To partially offset the demand, substantial quantity of fish is imported daily into the region from different parts of the country (Andhra Pradesh, Uttar Pradesh, Bihar, etc). This results in draining of funds from the region for a commodity, which could have been, produced in the region itself.

This is a sector which, integrated with the intensive farming systems approach, can significantly enhance rural income and livelihood security. In Eastern India the abundance of water and the generous monsoons can provide additional income to farmers through fish cultivation in paddy fields, besides the innumerable tanks, ponds, etc. It is ironical that this region, which

consumes large quantities of fish in the natural diet is dependent on import of fish from other States. A concerted effort is required to focus on the linkages needed to develop fish farming in the Eastern as well as North Eastern region.

Vast water bodies situated in reserve forests of the North Eastern States are lying untapped as the Forest Department does not have the wherewithal to develop such resources. Development of these resources should either be transferred to the Fisheries Department, or the Forests Department could develop the same in consultation with Fisheries Department and by involving local forest dwellers.

4.3.15 Post-harvest Management, Storage and Marketing: These are critical areas that are essential to enhancing the income of producers and for revitalizing the rural economy. In view of the conditions prevailing in the North Eastern and Eastern regions and the long distances between production centers and the main market, post-harvest losses of the produce of this region is inordinately high and the shelf life of perishables is low. If these regions are to become major production centers of fruit, vegetables and other perishable commodities the aspect of post-harvest management, storage and transportation assume prime importance. The lack of cold chain has been sorely felt in the region. The required infrastructure must necessarily be established, involving linkages from the collection centers to the retail outlets through retaining chambers, reefer vans, value addition centers, etc. State support, in this context, would be unavoidable in view of the difficulty in obtaining private participation of the required scale. The capital subsidy scheme in operation at present may be restructured in the context of the North Eastern region in order to facilitate the required large-scale expansion of post harvest and storage infrastructure.

The Eastern and North Eastern regions are characterized by the poorly developed marketing infrastructure, as a consequence of which producers receive much less than the optimum price for their produce. In the absence of an

efficient and responsive marketing system, production programmes too are not able to achieve expected returns. The approach should, therefore, be to promote a competitive marketing system by reviewing the existing legal framework, dismantling redundant controls and restrictions, creating the requisite infrastructure, and empowering producers through quality delivery and support systems and promotion of self-help groups. In view of the potential of the region to produce unique products, the importance of marketing becomes all the more critical. Innovative approaches are needed in this context, for which the region provides wide opportunities on account of the weakness of the existing mechanism.

4.3.16 Availability of institutional Credit: There is no doubt that production credit in the Eastern and North Eastern region needs to be scaled up. It is estimated that against the requirement of Assam, the credit flow in the state is only 2%. This highlights the need for extended and enlarged flow of institutional finance for production credit in the region. In this direction, Government of India needs to extend unrestricted and optimum line of credit to the refinancing agencies for further advancement. Agencies such as NABARD need to frame a separate policy initiative particularly for the North Eastern Region, aimed at strengthening as well as reviving the credit flow as well as credit absorption in the region. Further, NABARD on its part should not insist upon minimum involvement criteria, Government guarantee, etc. which are often found to be extremely restrictive for the cooperative agencies operating within the existing limitations of customs and traditions, land tenure system, traditional cropping patterns, lack of facilities for procurement, processing, storing, marketing etc.

The region has vast potential for Minor Irrigation Projects. Government of India/NABARD need to take a liberal view of the potentiality as well as requirement of the region and consider extending refinance at a concessional rate of interest, of say 5% instead of the existing 8.5%. Similarly,

the vast potential for financing agro based procurement, processing, storing, marketing, etc. needs to be financially exploited by the banking industry, particularly the cooperative banking sector. Urgent steps are needed to cleanse the balance sheets of State Cooperative Banks and Land Development Banks. The estimated requirement of external assistance for the purpose is Rs. 350 crores in the North Eastern States. In view of the special condition of the region, this infusion of funds appears fully justified.

The Agricultural Credit Review Committee had recommended creation of 'Agricultural and Rural Development Corporation' (ARDC) in the North Eastern region, to bring about a meaningful departure from the existing system agricultural lending. This still holds good and necessary initiatives should be taken for establishing state specific ARDCs in the North Eastern States to create and provide necessary impetus to the Agriculture and Allied Sector.

The weakest link in the cooperative credit sector of the region remains the grass root level societies in the form PACs, GPSS, SCS, LAMPS, FSS etc. Being the ultimate credit outlet, it is essential to strengthen and revitalize these grass root level societies in the North Eastern Region. Suitable schemes need to be evolved for rehabilitation, revitalization and strengthening of the grass root level societies in the region especially by providing share capital assistance, managerial assistance and infrastructural assistance.

4.3.17 Synergising the efforts of governmental/non-governmental

agencies: Keeping in view the resource potential of the North-Eastern region, particularly in respect of horticulture, floriculture, sericulture, rubber, tea, coffee and cashew plantations, forest resources, medicinal and aromatic plants and the enormous potential to develop value-added processed items, organizations like APEDA, Tea Board, Coffee Board, Spices Board, National Horticulture Board, Central Silk Board, Cashew Export Promotion Council, Forest Research Institute, Handicrafts and Handlooms Export Corporation, Handicrafts Board, Directorate

of Handlooms, CAPART, NAFED, TRIFED, STC, MMTC, and SFAC should evolve a joint action plan for promoting processing industries, infrastructure industries, packaging industries etc. and to providing linkages for marketing and export. So far the role played by national level governmental organizations has remained inadequate to have any impact on the pace of industrial development in the region. The North-Eastern Council may take the lead in organizing and developing an action plan by the concerned organizations.

State-level input agencies like Seeds Corporations, Agro Industry Corporations, Apex Cooperative Federations in the North Eastern region have failed to discharge their responsibilities, and it has become necessary that national institutions like NAFED, NCDC, NSC, NHB, SFAC etc. play a more direct role in implementation of targeted programmes. They will be required to undertake this additional responsibility only till such time as the State agencies are revived to play their assigned roles. These national institutions will have to play a vital coordinating role in input supply and marketing. This may even involve opening up regional offices of some of these organizations with senior functionaries with authority and delegation for decision making. Decision making could also be delegated to regional committees. The organizations may also be given the option to choose existing institutions like NERAMAC as their partners/counterparts. All this will, however, require prior concurrence of the concerned States, as well as budgetary support.

4.3.18 Attracting and Retaining Youth in Farming: The demographic profile in this region is marked by the predominance of youth. The greatest challenge to future food security is attracting and retaining youth in farming. Fortunately, thanks to new technologies such as biotechnology, information and communication technologies, space applications, renewable energy and bio-organic farming technologies, farming can become both intellectually stimulating and economically rewarding. Agricultural and Animal Sciences Universities should impart to students computer, trade and patent literacy and train them for a

career of self-employment. Farming graduates should be enabled to gain self-confidence to undertake the organization of Agri-clinics and Agri-business centers and provide facilities like pest proofing of crops, disease detection, nutrition management of farm animals, and advice on integrated crop-livestock-fish production systems. The youth taking to precision farming will also need the support of appropriate agricultural machinery. The testing and popularization of farm machinery should receive greater attention. An appropriate scheme should be formulated to provide credit to entrepreneurs and specialized training inputs.

4.3.19 Novel Systems of Extension Delivery: In order to transfer knowledge and innovations in the shortest possible time to the field level, novel systems of extension delivery need to be developed. The traditional extension systems of the States have not proved capable of providing farmers the requisite back up in the context of the on going information and scientific-technological revolution. Extension services need to be completely retooled and restructured, giving an incentive to the providers of service to deliver as quickly and effectively as possible. Government may play a catalytic and facilitative role in promoting development of private sector delivery mechanisms and consultancy services. This system would supplement the efforts of KVKs and, at the same time, prove attractive to educated youth and lend dynamism to rural agriculture.

4.3.20 Export Thrust: The North Eastern region is endowed with numerous natural resources. Agriculture, horticulture, floriculture, sericulture, forest resources, mineral resources offer abundant scope for producing value added items for exports. Exportable products include oranges, pineapples, apples, grapes, passion fruits, litchi, guava, bananas, bird eye chillie, asparagus, spices both in whole and ground form (particularly ginger and tej patta), floricultural products including orchids, medicinal plants and herbs, essential oils (lemon grass oil, citronella oil), organically grown food items including tea, and cane and bamboo products.

Cane and bamboo is available in almost all the States of the North Eastern region and local skills are available to add value by making a variety of cane and bamboo products. Recognising the potential of cane and bamboo in undertaking value-added production and in generating employment, incomes and foreign exchange by way of exports, the glaring deficiencies in terms of lack of marketing information, dearth of commercialisation and export orientation, absence of quality and product development, should be addressed. Marketing has to be given top most priority and it will be useful to enlist the services of a competent organization, whether public or private, at the national level to formulate a global marketing strategy and target distribution outlets like boutiques, hotels, departmental stores, retailers etc. The ASEAN markets, in particular, may offer unique opportunities for products such as those made of cane and bamboo. Active steps should be taken to encourage private investment in processing, manufacturing, marketing, as well as product development, market surveys, etc. The Govt. of India should also extend support to the handicrafts and handlooms sector in the North-Eastern region. The future looks extremely bright for this sector due to:

- proximity to the ASEAN Markets,
- abundance of good quality raw materials all over the region,
- low investment costs,
- high employment generating potential,
- environmental sustainability.

5. RECOMMENDED ACTION POINTS

The Vision and Approach to Development, the elements of which are outlined in Chapter 4, should form the basis of Tenth Plan strategy for the Eastern and North Eastern regions. In formulating holistic programmes centered on the individual components, the specific recommendations listed in this Chapter may be incorporated in developing an implementable Plan of action.

5.1 AGRICULTURE

5.1.1 Integrated farming systems: Very careful consideration must be given to the composition of the farming system. Soil conditions, water availability, agro-climatic features, home needs and above all, marketing opportunities should determine the choice of crops including horticultural and plantation crops, farm animals and aquaculture systems. Small and large ruminants will have a particular advantage among farm animals since they can live largely on crop biomass. Backyard poultry farming can help to provide supplementary income and nutrition.

5.1.2 Irrigation: The average utilization of ground water in the Eastern region is around 16 per cent. This can easily be increased to 60 per cent. For this special efforts are required through appropriate schemes for the use of ground water particularly in North Bengal, and parts of South Bengal, Bihar, Jharkhand, Eastern Uttar Pradesh, Orissa and Chattisgarh.

In the dry and sloping hilly areas of Orissa, western districts of West Bengal, Jharkhand, Chattisgarh appropriate schemes are required for collection, storage and use of rain water. In this regard, the watershed development programme should be strengthened.

Irrigation facilities in the North Eastern region should be developed by exploiting the ground water and harnessing rain water in the following manner:

- Utilization of ground water through establishment of shallow tube wells, deep tube wells, bore-wells etc. in the plain lands of Assam, Tripura, Manipur, Meghalaya, Arunachal Pradesh, Mizoram, Nagaland and Sikkim.
- Surface water may be utilized through lift irrigation, pumps etc.
- In hilly and sloping terrain, irrigation potential may be created through checkbunds, low irrigation, water harvesting structures etc.
- Collection and storage of rain water and its utilization for crops should be promoted.
- The Watershed development programme should be strengthened.

5.1.3 Shifting cultivation (Jhum): Productivity of crops under Jhum is very low because, of rainfed conditions, lack of proper inputs and production technologies. For development of agriculture in these areas, attention should be given to:

- Proper land development so as to convert it to settled cultivation.
- Introduction of terrace method of cultivation.
- Motivational and awareness creation programmes through pilot demonstrations and training.
- Agro-Forestry based cultivation including tea plantation, medicinal and aromatic plants, etc.

5.1.4 HYV and Hybrid Rice: Coverage under HYV in these States is very low. Due to high agro-climatic and topographic variation, location specific HYV is required in these areas. Intensive effort is required to increase the coverage under HYV initially through adaptive trial/frontline demonstration and then large numbers of general demonstration.

Coverage under hybrid rice in the North Eastern region, which is virtually nil, needs to be stepped up. Adaptive trial on hybrid rice has just commenced. Promotional measures for hybrid rice for accelerated coverage is required in these areas.

5.1.5 Appropriate technology/varieties for problem areas: A variety of problems affect the region. In Orissa, Jharkhand, Chattishgarh, Western parts of West Bengal, drought is a problem. Parts of Bihar have a water logging problem. Also, in parts of Bihar and North Bengal, the soil is acidic. Coastal salinity problem occurs in the coastal districts of West Bengal and Orissa. Specific technology and crop varieties are to be developed for these areas.

5.1.6 Seed: Average seed production in these areas is low because of infrastructural and climatic limitations. Intensive efforts are required for the production of seeds specially during rabi/summer season. Seed production prospects, particularly jute seed production, needs to be explored. Seed replacement rate is low in almost all crops which needs to be improved through appropriate measures, and farmers should be made aware of the advantages of certified seed.

Seeds being the most vital component for raising the productivity of crops, greater emphasis is to be given on production and making available certified/good quality seeds to farmers in time and at a reasonable price. The following steps may be taken for this purpose:

- Seed production infrastructures of the States should be strengthened, in terms of institutional arrangements, processing and storage facilities.
- Timely supply of Breeder Seed as well as Foundation seeds should be ensured. Foundation Seed production may be taken up within the State and also subsequently Certified Seed production by utilizing locational variations within the State. Seed Villages be set up to facilitate production of quality seed.
- Provision of transport subsidy of seed may be provided in North Eastern states for movement of seeds from seed growing areas.
- A Memorandum of understanding may be made with other States for production and regular supply of seeds in these states so that sufficient quantity of seed supply could be made possible on a regular basis.

5.1.7 Mechanisation: The status of farm mechanisation is poor in the North Eastern Region areas. Due to the hilly terrain, emphasis should be on use of small tractor/power tiller. However, in plain lands particularly in Assam, Manipur and other areas bigger tractors can also be used. Bullock drawn implements may also be popularised.

In the Eastern region as a whole, average holding size is low, and greater thrust should be given to power tiller and small farm tools.

5.1.8 Fertilizer: Use of fertilizer in the Eastern and North Eastern regions is very low as compared to other areas. The fertilizer consumption per ha is only 26 kg for the region as a whole. Intensive efforts are necessary to increase the use of fertilizer in these areas.

Transport is a major problem in the North Eastern States and accordingly the cost of fertilizer becomes high and sometimes it is not available in time. Greater assistance is required to provide fertilizer at a reasonable rate and efforts are also necessary to make fertilizer available in time. This may be ensured by opening of more outlets, besides timely prepositioning of fertilizer.

The use of fertilizer in some of the states like Orissa, Chattishgarh and Jharkhand is still very low. In other states also, it is low as compared to Panjab and Haryana. Efforts are necessary to increase the use of fertilizer

5.1.9 Bio-fertilizer/organic manure/organic farming: Considering the special nature and location of North Eastern States, emphasis should be on introduction of organic farming, use of bio-fertilizer and organic manure in these areas which in turn could be advantageous for export. Efforts are required for promotion of organic sources of plant nutrients.

5.1.10 Crop and Pest Management: Integrated Nutrient Supply (INS) and Integrated Pest Management (IPM) systems form important components of integrated farming systems. The precise composition of the INS and IPM systems will depend on the components of a farming system as well as on the agro-ecological and soil conditions of the area. Support should be extended to establishment of facilities for production of bio-control agents.

5.1.11 Quality control laboratory/Soil testing laboratory: To maintain proper quality of seeds/fertilizers/plant protection chemicals, quality control laboratories should be established. For application of proper doses of fertilizer to crops, soil testing is essential. Accordingly, a network of soil testing laboratories are required to be established.

5.1.12 Soil Health Care: This is fundamental to sustainable intensification. Integrated nutrient supply systems foster the inclusion of stem nodulating legumes like *Seasbania rostrata*, incorporation of Azolla, blue green algae and other sources of symbiotic and non-symbiotic nitrogen fixation and promotion of cereal-legume rotation in the farming system. In addition, vermiculture, composting and organic recycling constitute essential components of integrated farming systems. Moreover, maintenance of Soil Health Cards to monitor the impact of farming systems on the physical, chemical and microbiological components of soil fertility, must be encouraged.

5.1.13 Water Harvesting and management: In integrated farming systems, agronomic practices must be in tune with measures to harvest and conserve rain water, so that it can be used in a conjunctive manner with other sources of water. Where water is the major constraint, technologies which can help to optimize income and jobs from every litre of water should be chosen and adopted. Maximum emphasis be placed on on-farm water use efficiency and on the use of techniques such as drip irrigation, which help to optimize the benefits from the available water.

5.1.14 Increase in area under oilseeds and pulses: Overall coverage under oilseeds and pulses is low in the region. Greater emphasis should be given for the increase in area under oilseeds and pulses specially during rabi and summer seasons which will lead to greater crop diversification.

5.1.15 Extension Services: Farmers in these regions are still accustomed to their traditional method of cultivation. Extension services need to be strengthened for motivation, training, transfer of technology, etc. Transfer of technology from lab to land needs to be strengthened and innovative delivery systems should be developed. Educated youth, in particular, can be engaged to provide useful services in rural areas.

5.1.16 Energy Management: Energy is an important and essential Input. Besides the energy efficient systems of land, water and pest management, every effort should be made to harness biogas, biomass, solar and wind energies to the maximum extent possible. Solar and wind energy may be used in combination with biogas for farm activities like pumping water and drying grains and other agricultural produce.

5.1.17 Research Support: Because of large variations of agro-environment in this region itself, location-specific research needs to be developed and strengthened.

5.1.18 Marketing and storage: The region lags far behind in institutional marketing. Storage facilities are also inadequate. Support is necessary to strengthen and develop market infrastructure in these areas. Adequate attention is also necessary for the strengthening and further development of storage facilities in these areas. Special attention is required for the marketing of commercial crops like jute.

5.1.19 Credit: The imbalances in availability of production credit as compared to the other regions of the country needs to be removed through appropriate policies and administrative support. Similarly, cooperative lending is also virtually non-existent. This sector needs special attention as it is a key input for agricultural development.

5.1.20 Development of cultivable waste land: In the hilly terrain raising of crops, needs to be promoted on watershed basis. Farming systems in watershed areas should be developed for integrating field crops with horticultural crops, plantation crops, live-stock etc.

5.1.21 Drainage: In the valley areas, there is a problem of drainage congestion. Suitable developmental efforts are required for drainage improvement. Similar efforts are needed in Bihar, in the tal, दौरा, areas.

5.1.22 Channelization of funds: It has been observed that the existing system of channelization of funds of the Government of India sometimes does not make the funds available for timely implementation of programmes. The channelization of funds, therefore, needs to be critically looked into. An alternative method of fund transfer needs to be designed. In this connection, the method of channelization of funds for the Technology Mission for Integrated Development of Horticulture in the North Eastern Region through Small Farmers' Agri-Business Consortium Society, New Delhi, to the counterpart State Level Small Farmers' Agri-Business Consortium Societies in the North Eastern Region can be cited as a good example of overcoming the existing difficulties in making available funds to the Eastern and North Eastern Region States.

5.2 HORTICULTURE

5.2.1 Technological Support for improved production of quality fruits, post harvest handling and value addition: Horticulture production systems have become technology driven and success of development efforts depends upon introduction of improved technology and production of quality horticulture produce. Since most horticulture produce are perishable and need careful handling and value addition, adequate technical support is vital for sustained development of the sector. This could be achieved through effective linkages with existing research organisations and identification of critical gaps and, accordingly, development of technology especially suitable for the region.

5.2.2 Quality seeds and planting material: Quality seeds and planting material is a most important input which determines production and profitability of a horticulture venture. At present, there are limited facilities for the production

of quality seeds and plants, which is a major hindrance in achieving higher productivity. Therefore, it would be essential that an effective mechanism is developed for the production of quality planting material and seeds so that they may be made available at reasonable cost. Central Seed agencies like NSC should plan a larger role. NGOs and producers associations can also be involved in the activity. Certification systems to ensure the quality of seed have been established in some States, but these systems do not cover planting materials. Pests and diseases are resulting in debilitating orchards and are a limiting factor on production. Quality assurance machinery for seed and planting material, therefore, needs emphasis. With increased availability of quality seeds and planting material, area expansion can be taken up.

5.2.3 Improving Productivity in existing orchards: The North-Eastern and Eastern region have low levels of productivity of orchards, due to traditional systems of production and poor quality of planting material coupled with high incidence of insects, pests and diseases etc. In perennial orchards, productivity should be improved through rejuvenation of orchards which includes removal of diseased plants and replanting, improving plant health through nutrients management, especially micro-nutrients, management of insect pests and diseases, timely application of water etc. All efforts are needed to improve the productivity of senile and diseased orchards.

5.2.4 Efficient use of water and other inputs: Although plenty of water is available in the region, except in plateau areas, irrigation is limited. The sloping terrain does not permit the furrow or basin system of irrigation. Resultantly, most of rain water is wasted. Micro irrigation which is an efficient tool for achieving higher productivity in horticulture crops has to be practiced along with efficient on-farm management of water. The inefficient use of nutrients in these areas needs to be checked, as nutrient is one of the costliest inputs for horticulture crops. Integrated use of nutrients and water not only reduces the cost of inputs but also enhances productivity. Further, to check the degradation of soil

water and to maintain better health of soil, it is an imperative task to have integrated management of nutrients and water to achieve high output from the inputs.

5.2.5 Mechanisation: Many of the practices in horticultural crops are attended manually which adds to cost of production and reduces efficiency of utilisation of the human resource. Therefore, there is a need to mechanise many of the operations, using mechanical tools like power tillers, harvesters, power sprayers etc.

5.2.6 Transfer of technology: Horticulture, being technology driven, needs an effective system of technology transfer. The existing system in the region does not adequately cater to the growing needs. Involvement of private sector, NGOs, etc. is desirable. Trained manpower and setting up facilities on commercial lines may be encouraged. Establishment of plant health clinics is vital. Use of nutrients has to be monitored through soil and leaf analysis to achieve high efficiency and save wasteful use of nutrients. In the era of competition, quality of produce determines its marketability and facilities should be developed for determination of quality of produce in physical and chemical terms. New technology to be appreciated and adopted by the farmers, needs demonstration with their participation and also training. The best way to achieve the infusion of new technology is to ensure farmers participation in organising demonstration of technology in farmers fields, training of farmers and master trainers, use of media and also information technology.

5.2.7 Integrated Management of insecticides and pesticides: Insect pests and diseases cause serious damage to horticulture crops which is largely being managed through the use of insecticides and fungicides. However, it has been realized that continued use of insecticides and pesticides has created an ecological imbalance, apart from residue in the produce, which is harmful to human health. Therefore, it is essential to have

integrated management of insects pests and diseases through forecasting, use of bio-pesticides and bio- agents in a planned and systematic manner.

5.2.8 Organic Farming: Low use of fertilizer has been one of the weaknesses of North-Eastern and Eastern region of India. This weakness can be converted into opportunity by changing horticulture farms into organic farming systems. There is an increasing demand for organically grown food and demand is increasing at the rate of 15-20%. This system of farming not only provides residue free produce but also helps the soil health ,and thus the sustainability of the system. There is excellent scope for organic farming in this region through the use of bio-fertilizer and organic compost, coupled with integrated management of insect pests and diseases.

The North Eastern region has to be vested with a Unique Selling Proposition (USP) by labelling various products in the region especially in the agriculture and related sectors as organically produced or eco-friendly through proper publicity campaigns in which national level organisations need to play a major role. To obtain greater and easier acceptance of such organically grown products in developed country markets such as European Union and USA, certification by designated agencies in these countries may also be required. SFAC and NHB can perhaps play a pro-active role in this regard to assist APEDA.

5.2.9 Rubber and Rubber Products: Rubber cultivation in the North-Eastern region is important, particularly from the point of view of offering gainful employment opportunities to the tribal population. Tripura is the major producer in the North Eastern region. As the demand for natural rubber is increasing, it is necessary for the country to increase rubber cultivation particularly in the non-traditional areas such as the North Eastern States. In view of the proximity of Bangladesh, it will be worthwhile to assess the market demand for rubber

products in Bangladesh so that efforts could be made to undertake production of rubber products in Tripura as per its market requirements.

5.2.10 Organically Grown Tea or Bio-Tea: There are opportunities for India to produce many items to meet the demand for health food in developed countries. Of the many products, organically grown tea has among the brightest prospects. There is sizable demand from countries like Germany, France, Holland, Denmark, Japan and to some extent the US, for organically grown tea. The unit value realization for organically grown tea is around 40% more than the price of conventional tea. North-Eastern region has all the potential to emerge as a major producer and supplier of organically grown tea to the global markets. Organically grown tea should not use any chemical fertilizers and pesticides or any other inorganic materials; and there should have been no use of such material on the soil for the last five years where such bio-tea is grown. Private entrepreneurs should take advantage of the market prospects for bio-tea in the developed markets and commit investments to produce bio-tea in the North Eastern region. The State Governments should help the private enterprises where necessary to obtain the requisite certification from international servicing agencies involved in improving the exports of such special teas.

5.2.11 Mushroom Cultivation: More units for spawn production and pasteurized composting in mushroom should be set up. Such units must have training component for production and post harvest handling.

5.2.12 Floriculture: Although there has been expansion of area under floriculture, especially around cities, there exists huge potential for further expansion. There is a need for additional focus on this sector. Establishment of Model Floriculture Centres, development of regional gardens, development of modern flower markets etc. should receive attention.

5.2.13 Medicinal and aromatic plants: The traditional knowledge of inhabitants should be harnessed in providing focussed attention on development of medicinal and aromatic plants for achieving higher production and commercialization. Provision of quality planting material and production technologies for identified medicinal plants, including processing and market promotion should be taken up in an integrated manner.

5.2.14 Spices: Spices are important in the region, especially ginger, turmeric, chillies, cardamom and seed spices. Of late, black pepper has also been identified as a potential crop. Spices development programme should be given emphasis as a means to promote diversification and increase incomes.

5.2.15 Coconut/arecanut Cultivation: There is a growing awareness about cultivation of coconut in the region and the expansion of area under coconut has taken place which requires to be supported. The arecanut area may require to be replaced with improved cultivars by improving productivity.

5.2.16 Betelvine: Betelvine is a crop providing livelihood to a large number small holders in the region. Traditional methods of cultivation are continued, which have low productivity. Betelvine production system needs to be improved through technological support to achieve higher productivity.

5.2.17 Human resource development : One of the weaknesses in the North-Eastern and Eastern region is inadequacy of trained man-power and ill equipped Government Departments and institutions. Officers of the Department do not have access to recent technological developments. Procedures still follow traditional methods and there are very few skilled labourers and supervisors. Therefore, well targeted training programmes having provision for training of departmental staff, entrepreneurs, skilled labourers and supervisors need to be supported.

5.2.18 Promotion of honey bees: There is good potential for the development of honey bees as pollinators for improving productivity. Bee keeping not only helps in improving productivity of the crops but also provides opportunity to the landless poor youth to earn money. Bee keeping must, therefore, be promoted with an integrated approach for increasing productivity and generating incomes.

5.2.19 Data Base development through remote sensing: The data base of horticulture is very poor in North-Eastern and Eastern regions, which is an impediment in the planning process. Remote sensing has potential in assessing the area and production and also identifying the areas which hold promise for horticulture development. Remote sensing coupled with ground surveys should be used for generation of vital databases.

5.2.20 Risk Management: Risk management through insurance cover has been provided to agriculture crops. Horticulture crops are not covered due to the inadequacy of reliable data. However, horticulture crops have higher risk and perennial orchard losses are immense. Therefore, there is a need to provide a mechanism for providing insurance cover which will encourage horticulture development.

5.3 POST-HARVEST OPERATIONS

5.3.1 Infrastructure for Post Harvest Management: Development of horticulture, largely depends upon post harvest management which includes proper harvesting, grading, packing, storing, transporting etc. In the absence of proper infrastructure a very high proportion of horticulture produce is lost during different processes of handling. Therefore, there is urgent need to provide infrastructure for post harvest handling and reduction of losses. The States may consider setting up Horticulture Development Boards on the pattern of NHB to help in creation of infrastructure for post harvest management.

5.3.2 Marketing: Marketing is a vital link in the chain of production to consumption, which determines the profitability of farmers and also investment capability. A sound system extending from collection and dissemination of marketing intelligence to final retailing to the consumer is essential. Market facilities at village level linked with terminal market have to be provided. To improve profitability of horticulture produce, the backward and forward linkages must be tied up so that production can be undertaken as per the consumers needs. Existing APMC regulations need to be reviewed and modified so as to break the restrictive monopolistic approach and to encourage alternate models.

To assist the State Governments in their efforts to reward the farmers with remunerative prices, NERAMAC may have to devote itself totally to the marketing function rather than spending its scarce resources and efforts in running processing plants. Until the volumes of production reach commercially viable levels, NERAMAC may also help the private processing plants in the procurement and supply of essential inputs including cans for packing purposes. At a later stage, it may become viable for the can manufacturing factories in the country to establish a factory in the North-Eastern region to meet the requirements of the local processing units. Cooperative Marketing Organizations such as NAFED and TRIFED should commit themselves to purchase fruits and vegetables and other agro-based and forest-based items from the North-Eastern region for marketing both within the country and abroad. NAFED particularly may even encourage the setting up of mini-plants to undertake primary processing close to the areas of production and move the output in concentrated form in bulk, to the factory for undertaking production of value added items in consumer packs.

The effort to put in place an efficient and pro-farmer agriculture marketing system must focus on the following:

- Promotion and development of border trade with Bangladesh, Nepal, Bhutan, etc.
- Rejuvenation of old defunct cooperative marketing societies and constitution of new societies or Self-help Groups at the grassroot level as well the district and state levels.
- Area specific and commodity specific integrated marketing strategies, from producer to terminal markets where the produce is to be sold. These individual schemes should be self-contained down to the minutest detail of procurement, disposal and margins.
- Professional training, capacity building and empowerment of staff of processing units, cooperative marketing organizations, etc.
- Setting up an efficient network of market intelligence of commodity prices in terminal markets so that farmers even in remote areas become aware of the consumer price of their produce.

5.3.3 Institutional Support: Institutional support to farmers and entrepreneurs is very weak in the region. Most State Departments do not have adequate manpower, transport, communication infrastructure etc. Due to ill-equipped staff, poor mobility and communication facilities, efforts for the development of horticulture are not likely to achieve the goal. Therefore, it is essential to develop the institutional framework in terms of man power and necessary infrastructure. The farmers should be encouraged to cooperativise or organize themselves in groups. Formation of crop-wise association should be supported.

5.3.4 Value addition and food processing: Value addition and food processing is essential especially for horticulture produce. Many of the processing units established in the past in North-Eastern and Eastern region have not performed well and have only old and inefficient machinery. Multi commodity processing facilities having linkages with producers need to be

promoted. In order to avoid wastage, facilities for value addition through processing in localised areas where production is taking place have to be promoted both in the public as well as private sector. Promotion of joint venture enterprises to be managed by the private sector, but with adequate representation on the Board of public/cooperative sector coordinating agencies who can look after farmers' interest may be considered.

5.3.5 Awareness building on quality issues: As achievement and maintenance of quality parameters will be the key to competitiveness and profitability, special efforts are needed for creation of awareness among producers, processors, traders and all other stake-holders. Awareness building on global quality standards, sanitary and phyto-sanitary measures, Codex Alimentarius standards must be undertaken through intensive capacity building and training programmes.

5.4 Research & Development

5.4.1 ICAR Institutions: The ICAR complex at Barapani (Meghalaya) with centres in all the hill States will have to play a very important role in generation of location specific technologies through its breeding and research work and assist the States to disseminate them to the farmers. In order to strengthen the Complex to play its designated role, the issue of chronic shortage of staff should be seriously addressed with an element of flexibility so as to attract the best local expertise. In order to enhance its effectiveness in the region, the Complex should start interacting with the States with a proper institutional set up and take up research projects with mutual consent. The Eastern region has a fair share of research institutions. The synergy between these institutions, including agricultural universities and KVKs, on the one hand, and farmers, producers and user organizations on the other hand, needs to be strengthened. Regular and frequent inter-action, training and demonstration, innovative means of information dissemination need to be promoted.

5.4.2 **Future research and developmental thrusts:**

- Inventorization, characterisation and monitoring of various natural resources using modern tools and techniques, especially remote sensing and GIS for development of sustainable land use plans for each agro-ecological sub-region.
- Development of location specific model watersheds in various agro ecological sub-regions of the rainfed areas to enhance the average productivity.
- Increase in fertilizer use efficiency and its integrated use with organics by enhancing the contribution of organics including bio-fertilizers through integrated plant nutrient management system.
- Increasing overall cropping intensity by over the current level with promotion of energy efficient alternate land use systems especially by low water requiring crops.
- On-farm water management to enhance water-use efficiency through conjunctive water use with large scale introduction of water users associations as well as micro-irrigation and fertigation systems.
- Development of cost effective drainage technology including bio-drainage for control of saline and water-logged and flooded situations.
- Medium range weather based expert systems for enhanced production improvement through media based Agromet Advisory Services.
- Large scale introduction of cost effective methods of resource conservation and reclamation technologies especially for current fallows and culturable wasteland.
- Development of location-specific seeds and planting materials for enhancing productivity levels.
- Increasing the marketability and improving/maintaining the quality of traditional fruits and vegetables, medicinal and aromatic plants, etc.
- Re-tooling of extension and information dissemination systems and development of innovative models for efficient transfer of technology.

5.4.3 Transfer of technology: A severe weakness in the agriculture scenario of the Eastern and North Eastern regions is the near absence of an extension system. Hence, the transfer of technology from the lab to the field is extremely weak and producers still rely on traditional methods. A serious effort is needed to revamp extension services so that the benefits of science and technology are brought to bear on production operations. This may be achieved through “knowledge centers”, Agri-clinics and Agri-businesses, KVKs, ATMAs or other effective models. Innovative solutions are called for to harness biotechnology, information technology, remote sensing technology and other frontier technologies to agricultural production. Consultancy services may also be encouraged in order to make available to the farmer knowledge of best practices. These models would also serve to retain educated youth in rural areas.

5.5 Animal Husbandry Sector: Taking into consideration the conditions prevailing in the Eastern and North-Eastern regions the States need to formulate plans which are suited to the people of the region. Barring a few pockets of Bihar, Orissa, Chhatisgarh, and West Bengal which can be exploited for dairy development, the rest of the region, due to reasons of geography and socio-cultural composition is best suited only for the development of monogastric animals and backyard poultry and piggery. The region has a great potential for development provided requisite inputs are made available at the door step of the farmer by improving the delivery system. An integrated development programme combining an area-specific farming systems approach with a regional strategy is essential to tap the rich bio-diversity of this region. This will entail providing an effective, institutional framework for the region so that there is improvement in the infrastructure and delivery system, which, unfortunately, is almost non-existent, today. The suggested measures are:-

- A regional approach for the development of infrastructure in the North Eastern states, as the existing state-based planning, has not proved to be cost –effective. For reasons of geography and socio-

economic diversity it may not be proper to equate North-Eastern states with the Eastern region.

- Barring some pockets of Bihar, Orissa, Chhatisgarh and West Bengal, the rest of the East and North-East should concentrate on promotion of small ruminants and monogastric animals and backyard poultry.
- Optimise the use of crop residues through provision of appropriate feed supplement and conservation of green fodder;
- Improve marketing network, through networking of surface communication. A regional approach, instead of a State-specific approach will be more appropriate;
- Supply of essential inputs needed for the livestock sector, like germplasm for genetic upgradation, feed and fodder biologicals and parent stock/hatching eggs for backyard poultry, through an organized set up;
- Strengthening of the disease control mechanism;
- Setting up a Livestock Development Board/Agency, on the lines of National Dairy Development Board (NDDB) with full autonomy, managed by professionals, and a clear mandate to promote livestock development, provide essential inputs and credit, set up marketing network and enhance HRD.
- The credit flow in this region for livestock is very poor. There is a special need to strengthen institutional financing, with a differential rate of interest;
- Economic studies on live-stock should be initiated and a dynamic data base built up to aid future planning for the North-East.

5.6 Fisheries sector: The Eastern and North Eastern region provides enormous potential for development of fisheries, which include inland fisheries in the flood plains and estuaries as well as upland and cold water fisheries, marine

fisheries including deep sea fishing, and aquaculture. In order to tap the opportunities offered by the sector, the following measures are needed:

- Development of flood plain fisheries by desiltation, dewatering, etc.;
- Provision of high quality spawn and fingerlings to farmers;
- Integration with farming systems and especially with paddy cultivation;
- Development of suitable technologies for location specific production;
- Preparation of cold water fish species like mahseer, trout etc. for high altitude water bodies;
- Provision of suitable craft and equipment for fishing operations in rivers and streams;
- Strengthening of delivery systems and transfer of technology to producers.
- Development of processing and storage infrastructure for the sector;
- Enhancement of investment in processing, storage and transportation, particularly from the private sector through appropriate incentives;
- Strengthening of transportation and communications network;
- Development of marketing infrastructure and facilitation of trade;
- Promotion of exports from the sector;
- Development and maintenance of quality standards.

5.7 Enhancement of Credit: Credit is one of the most critical weaknesses in the development of agriculture and allied sectors in the Eastern and North Eastern regions. Not only is the cooperative credit structure practically defunct, but RRBs and commercial banks are comparatively inactive in making available much needed credit to producers. For removal of poverty and creation of livelihood opportunities micro-enterprises based on micro-credit are expected to be the key element. The following measures need to be considered for enhancing the level of credit in the sector:-

- Establishment of a large network of micro-enterprises based on local conditions;

- Provision of micro-credit to such enterprises with the minimum of procedural formalities;
- Commercial banks and RRBs should play an increasingly active role in the region, in the absence of the cooperative structure;
- Self-Help Groups should be encouraged and credit flow to them be enhanced;
- Production credit should be enhanced substantially in the region, if necessary by making adjustments in banking norms and procedures;
- Level of investment in infrastructure be stepped up substantially;
- The possibility of availing financial assistance under RIDF be made more attractive to States of the region;
- Creation of Agricultural and Rural Development Corporations in some of the States of the region be explored;
- Efforts be made to revive the cooperative structure and to restore the health of the cooperative banks by cleansing their balance sheets;
- Appropriate statutory support be provided for expanding availability of credit.

5.8 INSTITUTIONAL STRENGTHENING

5.8.1 Agriculture and Horticulture Departments, besides those dealing with Animal Husbandry and Fisheries, in the State Governments are relatively ill-equipped to meet the challenges of today. Apart from being outdated in their knowledge and perceptions, their procedures and systems are not designed to meet modern day needs. A comprehensive human resource development programme needs to be mounted in order to reorient and re-educate Government functionaries and others. In addition, procedures and systems too need to be reviewed and revised, so as to ensure smooth and efficient delivery of services.

5.8.2 It would also be useful to utilize the services of autonomous and semi-autonomous agencies, NGOs, registered societies, joint venture companies, besides the private sector, for implementation of programmes and promotion of agriculture sector goals. The country has several experienced and

competent organizations in various commodity sectors which should be invited to play a more significant role in the Eastern and North Eastern regions. The expertise and resources of such agencies may be pooled in order to provide the required foundation for development programmes in the region.

APPENDICES

Composition and Terms of Reference of the Working

Terms of Reference:

- i. To review the agricultural development programmes/schemes, under implementation in the Eastern and North Eastern States, during the Ninth Plan with respect to achieving the targets set and increasing productivity levels of foodgrains and other agricultural commodities.
- ii. To assess the existing productivity potential of various crops, fruits and vegetables and livestock products, identify the factors responsible for the gap in between existing potential and the productivity levels realized at farm level and suggest measures/policy initiatives to effectively address the problems being faced in realizing the potential.
- iii. To assess the scope for diversification of agriculture in the region considering the prevailing/favourable agro-climatic conditions so as to generate additional on-farm employment and incomes of the rural population/households.
- iv. To assess the scope for propagating backyard agriculture and suggest the areas and measures for their propagation for increasing the income of rural households.
- v. To assess the requirement of inputs especially quality seeds/planting material, fertilizers, credit etc. to optimize the production and productivity levels and suggest measures/programmes for the Tenth Five Year Plan to achieve the adequacy in input supply.
- vi. To review the impact of programmes/measures taken to minimize soil and water erosion, land degradation and flood control and suggest measures to make such programmes more effective and for taking new initiatives to cope up with the land degradation problems.
- vii. To review the minor irrigation development in the region with respect to the potential existing, created and utilized during the Ninth Plan, and suggest measures to accelerate the pace of development of minor irrigation in the region.
- viii. To review the programmes implemented during the Ninth Plan for the development of Animal Husbandry & Dairying and improvement of cattle and other local animal species races including the Artificial Insemination (AI) and Immunization Programmes in the region and suggest measures for accelerating the growth development of animal husbandry sector.
- ix. To assess the scope for the fishery development, status of utilization of water resources for the same and suggest measures for the effective utilization of available water resources for fish production and propagation of rice-fish culture.
- x. To study the existing market infrastructure and suggest measures for the development so as to provide assured market for the farm surplus produce for local consumption as well as to promote the exports.

Composition:

- | | | |
|-----|----------------------------------------------------------------------------------------------------------------|-------------------|
| 1. | Shri Bhaskar Barua
Secretary (A&C)
Deptt. of Agri. & Coopn.,
Krishi Bhawan, New Delhi. | Chairman. |
| 2. | Agriculture Commissioner
Deptt. of Agri. & Coopn.
Krishi Bhawan, New Delhi. | Member. |
| 3. | Deputy Director General (Crop Sciences)
Indian Council of Agricultural Research
Krishi Bhawan, New Delhi | Member. |
| 4. | Chief Secretary
Govt. of Manipur, Imphal. | Member. |
| 5. | Chief Secretary
Govt. of Meghalaya, Shillong. | Member. |
| 6. | Chief Secretary
Govt. of Mizoram, Aizwal. | Member. |
| 7. | Chief Secretary
Govt. of Nagaland, Kohima. | Member. |
| 8. | Chief Secretary
Govt. of Sikkim, Gangtok. | Member. |
| 9. | Chief Secretary
Govt. of Tripura, Agartala. | Member. |
| 10. | Chief Secretary
Govt. of Arunachal Pradesh, Itanagar. | Member. |
| 11. | Agriculture Production Commissioner
Govt. of Assam, Gauhati. | Member. |
| 12. | Agriculture Production Commissioner
Govt. of Bihar, Patna. | Member. |
| 13. | Director (Agri.) & Ex-Officio-Secretary (Agri.)
Govt. of West Bengal, Patana. | Member. |
| 14. | Secretary (Agri.)
Govt. of Orissa, Bhubaneshwar. | Member. |
| 15. | Secretary (Agri.)
Govt. of Jharkhand, Ranchi. | Member. |
| 16. | Secretary (Agri.)
Govt. of Chhattisgarh, Raipur. | Member. |
| 17. | Secretary (Agri.)
Govt. of Uttar Pradesh, Lucknow. | Member. |
| 18. | Joint Secretary (PC)
Deptt. of Agri. & Coopn.
Krishi Bhawan, New Delhi. | Member-Secretary. |

Appendix-II

DETAILS OF AGRO-ECOLOGICAL SUB-REGIONS

Agro-Ecological Sub-region	State	Rain-fall (mm)	Soil	Cropped Area (m ha)	Cropping Intensity (%)	Major Crops	Major Issues
9.2 Hot, dry sub humid	Bihar	1000-1200	Deep, Loamy (Inceptisols)	5.5(4.1)	172	Maize, Millet, Paddy, Pulses	Water-Logging And salinity places of unjudicious water use Saline Sodic underground water
12.1 Hot, moist sub-humid	Orissa	1400-1700	Red, Sandy, Red and Yellow and Medium to Deep Black (Inceptisols, Alfisols, Entisols, Vertisols)	11.6	110	Rice Maize Oilseeds Minor Millet cotton	Soil erosion Seasonal aroughness Gravellyress in subnil Ground Water Exploitation Due to rockyness
12.2 Hot, moist sub-humid	A.P.	1200-1600	Hilly soil (Inceptisols, Alfisols, Ultisols, Vertisols Entisols)	3.3	133	Sorghum Groundnut Rice Maize Oilseeds Pulses	Severe soil erosion, seasonal droughty ness Low PAWC Soil acidity Soil crusting
12.2 Hot moist, sub-humid	Orissa	1200-1600	Hilly soils, (Inceptisols, Alfisols, Ultisols, Vertisols Entisols)	3.3	133	Sorghum Groundnut Rice Maize Oilseeds Pulses	Sever soil erosion Seasonal droughty ness Low PAWC Soil acidity Soil crusting
12.3 Hot, dry and moist	Jhar-Khan	1200-1500	Red sandy to loamy	2.0	112	Rice Maize	Severe soil erosion

sub-humid	d		(Inceptisols Altisols, Entisols)			Pigeon- pea Wheat Potato Vege- Tables	Low AWC
13.1 Hot, dry/moist subhumid	Bihar	1200- 1500	Deep, Fine loamy to clay (Inceptisols pocets of Altisols)	6.0	150	Rice Wheat Pulses Mustard Sugarcane Species Condiume nts	Imperfect Drainage Flooding Salinity/ Soldicity
15.1 Hot, subhumid to humid	W.B.	1300- 1600	Brown, hilly, Deltaic alluvial (Inceptisols Altisols, Entisols)	3.3	138	Jute Rice Mustard Latharus Lentil Wheat Vege- Tables Potato	Frequent flooding and water- Logging Salinity Sodicity
15.2 hot humid	Assa m		Upper Brahmaputr a plain	NA	110	Rice Mustard Latharus Lentil Vege- Tables Potato	Frequent flooding and water- Logging
15.3 hot moist humid	Assa m		Brahmaputr a plain and Barak valley	NA	115	Rice Mustard Latharus Lentil Vege- Tables Potato	Frequent flooding and water- Logging
15.4 warm to hot perhumid	Assa m		Lower Brahma- putra plain	NA	120	Rice Mustard Latharus Lentil Vege- Tables Potato	Frequent flooding and water- Logging
16.2 warm per humid	Sikki m,		Darjiling and Sikkim	NA	120	Rice Mustard	Severe soil erosion,

	W.B.		Himalayas			Wheat. Lentil Vegetables Potato, Fruits	seasonal drought, PAWC acidity crusting	Low Soil Soil
17.1 warm to hot moist- humid to perhumid	Meghalaya and Nagaland		Meghalaya plateau and Nagaland hill	NA	110	Rice Mustard Wheat. Lentil Vegetables Potato, Fruits	Severe soil erosion, seasonal droughty ness Low PAWC Soil acidity Soil crusting	
18.4 Hot, dry subhumid	A.P.	1200- 1500	Coastal Alluvial		133	Rice, Pulses, Groundnut Sesamum, Wheat Potato	Imperfect Drainage Soil salinity Sodicity	
18.5 Hot moist, sub- humid	Orissa	1200- 1800	Gangetic delta		130	Rice, Pulses, Ground nut Sesamam, Wheat Potato	Imperfect Drainage Soil salinity Sodicity	

Source: Agro-ecological sub region of India for planning and development, NBSS&LUP, Nagpur.

**Estimates of Milch Cattle and Milk Production in Eastern and North
Eastern Region (1994-95)**

S.No.	State/UTs	No.of Cross Bred Cows (000.No.)	No.of Non Descript Cows (000.No.)	No. of Buffalo (000.No.)	Estimates of Milk Production (000.tonnes)
1	Arunachal Pradesh	9	25	-	22
2	Assam	140	2872	208	672
3	Bihar	188	5125	3319	2865
4	Manipur	-	-	-	-
5	Meghalaya	11	178	9	54
6	Mizoram	3	14	-	9
7	Nagaland	-	101	-	43
8	Orissa	261	3698	391	582
9	Sikkim	-	-	-	-
10	Tripura	-	-	-	38
11	Uttar Pradesh	531	6051	8709	10654
12	West Bengal	575	4883	214	3217

LIST OF ICAR INSTITUTIONS IN EASTERN AND NORTH EASTERN STATES

CROP SCIENCES

1. Central Institute for Jute & Allied Fibres,
24, Paraganas, Barrackpore – 743101,
(West Bengal).
2. Central Rice Research Institute,
Cuttack – 753 006 (Orissa).

HORTICULTURE

3. National Research Centre for Orchids,
Pakyong – 737 106 (Sikkim).

NATIONAL RESOURCE MANAGEMENT (NRM)

4. ICAR Research Complex for North Eastern Hill Region,
Umroi Road,
Barapani 793 103 (Meghalaya).
5. Water Technology Centre for Eastern Region,
Near Nalco Nagar, Chander Shakharpur,
Bhubaneswar – 751 012 (Orissa).

AGRICULTURAL ENGINEERING

6. National Institute of Research on Jute &
Allied Fibre Technology,
Regent Park,
Calcutta 700 040 (WB).
7. Indian Lac Research Institute,
P.O. Namkum, Ranchi – 834 010,
Bihar.

AGRICULTURAL EXTENSION

8. National Agricultural Statistics Research Institute,
93-Dharma Vihar, Khandagiri- P.O.
Bhubaneswar 751 030 (Orissa).

ANIMAL SCIENCES

9. National Research Centre on Mithun,

ICAR Research Complex, Jharnapani,
Distt. Kohima-797 106 (Nagaland).

10. National Research Centre on Yak,
Dirang, West Kameng,
(Arunachal Pradesh)-790 101.

FISHERIES

11. Central Inland Capture,
Fisheries Research Institute,
Barrackpore – 743 101,
West Bengal.
12. Central Institute of Freshwater Aquaculture,
P.O. Kausalyaganga,
Via Bhubaneshwar-751 002, (Orissa).

APPENDIX - V				
DETAILS OF BANKING STRUCTURE IN NORTH EASTERN STATES				
(Rs.in lakh)				
Particulars	SCBs	DCCBs	SCARDBs	RRBs
Number	7	1	3	11
No. of Branches	214	19	25	647
Owned funds	9597	558	1087.24@	13679.22
Deposits	84411	1757	31.59	113550.08
Deposits growth rate (%)	13.35	15	(-)1.6	24.41
.....do..... All India	15	24	20	19
Loans and advances outstanding	41502	949	2852.85	39717.05
Growth rate of loans & advances (%)	9.3	1.6	8.3	15.9
.....do.....All India	15	24	14	16
CD Ratio (%)	30	54	NA	43.76
Loans disbursed during 100\1998-99	31406	182	327	10795.09
Growth in loans disbursement (%)	10.6	469	100	11.7
.....do.....All India	13	24	6	24
Recovery percentage to demand	22.8	5	17%@	29.95
.....do..... All India	81	70	62	64
Percentage of NPAs to loans outstanding	50	84	NA	44
.....do.....All India	13	18	19	23
Current profit/loss during 1998-99				
Profit	98 (3)	-80	79.06\$	1633.72(8)
Loss	2144(4)			783.16(3)
Accumulated losses		1131	2117.08@	28219.86
Total erosion in assets	232.07(5)	1545	2552.43(3)@	
Erosion of public deposits (%)	14.46	51	NA	13.2
No.of banks having more than 25% erosion of deposits	2	1	NA	
Banks not complying with statutory provisions (Sec.ii(I) / Sec.42(6)(a)(I)	5	1	NA	7
Investment refinance provided by NABARD to banks in NE Region during 1998-99	143.25	NA	340	2011
Credit limit sanctioned 1998-99	7.68	NIL	340	1.2
ST credit maximum o/s.1998-99	5.34	NIL	NIL	0.32
Credit Limit sanctioned 1999-2000	6.45	NIL	339	NIL
(Figures in brackets indicate number of banks)				
@ Position as on 31 March 1998				
\$ Data in respect of Assam SCARDB not available				

PROBLEMS & SOLUTIONS OF SELECTED ECO-SYSTEMS

COASTAL ECO-SYSTEM

Situational Analysis-Problem Identification: Suffering from saline ground water, sandy surface of coastal eco-system some times and at some places, as shifting sand dunes, support only such vegetation which are acclimatized, like casurina, mangrove, palmera, coconut etc. However, such areas have medium to high rainfall and people have developed a number of location specific rainwater-harvesting-systems for raising crops, trees, drinking water etc., for sustainable living.

Proposed technology:

A. Conservation measures

1. Promotion of shallow wells (baby wells) to receive fresh rainwater percolating through sand columns. The wells should be shallow so that fresh water does not mix with saline water.
2. Plantation of shelterbelts.
3. Kuttai i.e. deepening or renovating shallow dug-out impressions of small size, to collect rainwater around which some cropping and planting of trees may be done.
4. Repairing of existing conservation measures including deepening/renovation of village ponds.
5. Contour cultivation.
6. Renovation/development of ponds in the depressions and beds on higher lands for brackish-water aquaculture and tree plantation.
7. Contour vegetative hedges.

B. Production Systems:

1. Crop Demonstrations.
2. Agro-forestry, Alley cropping, boundary; plantation.
3. Dry-land horticulture (hardy and multipurpose species) including plantation of acclimatized trees like casurina, cashew, salvadora, and coconut; shrubs like lemon, guava, banana near baby wells, and cultivation of vegetables etc.
4. Pisciculture.
5. Organic farming systems and integrated nutrient management systems including addition of farmyard manure for increasing moisture-holding capacity of the soils.
6. Over seeding of grasses and legumes in uplands.
7. Planting of shrubs (uplands) and trees (low lying areas with raised mounds).
8. Mangrove plantation.
9. Homestead garden, kitchen garden.
10. Household biomass production systems (for marginal and landless farmers).
11. Livestock-management including small livestock systems specially goats.
12. Floriculture-Jasmine and mogra on southern coast.

WATERLOGGED ECO-SYSTEM

Situational Analysis – Problem Identification: There is a vast natural area due to drainage-congestion starting from mid Uttar Pradesh and passing to north Bihar, north West Bengal and southern Assam. The water-logging during rainy season affects crops and creates problem of transport and movement. Such areas are also affected with health hazards like Malaria, Kalazar, elephantiasis etc. in human beings and liver-flue disease in livestock.

Proposed technology:

A. Conservation measures:

1. Contour vegetative hedges.
2. Repair of existing conservation/drainage measures.
3. Contour cultivation on higher slope area.
4. Shallow bore-well with pumping sets for encouraging vertical drainage.
5. Percolation wells with pump sets.
6. Deepening/renovation of village ponds.
7. To develop water cavities/deepening of depressions for aquatic farming.
8. Live-fencing.

B. Production Systems:

1. Crop demonstrations.
2. Agro-forestry, Alley-cropping, boundary-plantation.
3. Dry-land horticulture (hardy multipurpose species).
4. Organic farming-systems.
5. Over-seeding of grasses and legumes.
6. Planting of shrubs.
7. Planting of trees on rainfed lands, in low-lying areas with raised bunds.
8. Fish culture.
9. Makhana cultivation.
10. Singhara cultivation.
11. Homestead garden.
12. Household biomass production/processing system for marginal and landless farmers.

Viii. HIMALAYAN ECO-SYSTEM

Situation Analysis – Problem Identification: Characterized by high slopes, medium to high rainfall, high rate of soil erosion, depleting vegetative cover, shortening of the life springs and streams, generating tremendous amount of silt with high volume and speedy surface flow. Basic need to convert surface-flow to subsurface recharge for increasing prolonged and off-season stream-flow, reduce speedy surface-flow and soil erosion and restoration of ecological balance.

Proposed technology:

A. Conservation measures:

1. Contour vegetative hedges supported by trenches/stone bunds.
2. Repair of existing conservation measures including inter-terrace treatment.
3. Gully-control measures with vegetative systems.
4. Contour cultivation.

5. Strengthening/repair and vegetative enforcement of terraces.
6. Vegetative filter-strips in place of diversion drains.
7. Live fencing.
8. Spring-water/runoff utilization devices (traditional/innovative).
9. Renovation of traditional ponds, kua, naula.
10. Roof-water harvesting.
11. Landslide-control systems.
12. Brushwood checks.
13. Speed-breaker type gabion structures to regulate the flow/velocity at appropriate points, rainwater-conservation and drainage-line treatment.
14. Deepening and renovation of existing village ponds.
15. Bank-stabilization mostly with vegetative measures.
16. Treatment of upper reaches by live checks, brushwood checks, loose boulder structures with vegetative support.
17. Treatment of middle reaches by loose boulder speed-breaker type structures with sunken silt-catch-pits upstream, earthen checks with sunken silt-catch-pits upstream and runoff-management dugout devices along drainage-lines with vegetative inlet and outlet with minimum pitching.
18. Treatment of lower reaches by dugout runoff and silt-collection devices with vegetative support, network of recharge pits on stable areas above naulas and water ponds, runoff transfer devices on unstable areas.
19. Repair/construction of water mills.

B. Production Systems:

1. Crop demonstratins.
2. Agro-forestry, Alley-cropping, boundary plantation.
3. Dry-land horticulture (hardy multipurpose species).
4. Organic farming systems.
5. Three-tier system of plantation in a horizontal topo sequence.
6. Over seeding of grasses and legumes.
7. Planting of shrubs.
8. Planting of trees mostly along drainage lines.
9. Homestead garden.
10. Household production/processing systems.
11. Livestock management system.

**ESTIMATE OF PER HECTARE INVESTMENT AND RETURN ON VARIOUS ACTIVITIES
WITHOUT NEW TECHNIQUES**

	CROPS	PER HECT INVESTMENT (RS.)	PER HECT. INCOME PER YEAR (RS.) (GROSS)
1.	FISH (EXISTING BEELS AND PONDS)	115900	140000
2.	FISH (NEW WATER BODIES)	1168540	140000
3.	TEA (UPTO 2 ND YEAR)	110250	14000-70950(2 ND -6 TH YR. (NET INCOME))
4.	BANANA	47385	102000
5.	MUSHROOM	31000	60000
6.	LENTIL	8397	16200
7.	ARECANUT (UPTO 5 TH YR)	58663	49500-173250
8.	MUSTARD	7904	12000
9.	MUGA	22180	5452-21300(5 TH -9 TH YR)
10.	RUBBER (UPTO 5 TH)	45960	15000-57000(8 TH -13 TH YR.)
11.	CHILI	15640	25000
