Agricultural Diversification in North Eastern Region of India: Implications for Growth and Equity

P.S. Birthal*, A.K. Jha*, P.K. Joshi[†] and D.K. Singh*

I

INTRODUCTION

The north eastern region (NER)[1] lags behind the rest of India in economic development. Between 1993-94 and 2002-03, gross domestic product (GDP) in the region grew at an annual rate of 4.3 per cent and per capita GDP at 2.4 per cent, which are much lower than the corresponding growth rates of 6.0 per cent and 4.1 per cent at the national level. The per capita GDP in the region in 2002-03 was Rs. 8,400 (1993-94 prices), which was about three-fourth of the national average.

Agriculture is an important economic sector in the NER. In 2002-03 the sector contributed over 30 percent to the gross domestic product. Its importance, however, transcends beyond economic contribution. It is the main source of livelihood for a majority of rural population, which is about 85 per cent of the total population. In 1999-2000 about 61 per cent of the work force was engaged in agriculture and allied activities. Further, 40 per cent of the rural population lives in poverty. However, agriculture in the region is characterised as subsistence, low-input and technology laggard. Over 86 per cent of the land holdings are ≤ 2 ha in size (Government of India, 1999). Rice is the main crop occupying more than 60 per cent of the cropped area with an average yield of 1.6 tonnes/ha (FAI, 2003), compared to the national average of 2.1 tonnes/ha. Fertiliser use is about 42 kg/ha, and irrigation is limited to about 10 per cent of the gross cropped area (FAI, 2003). Fostering rapid growth in agriculture is thus, necessary to augment income and employment opportunities for the rural people in the region.

Agricultural diversification is one of the several pathways of agricultural development. The demand for high-value food products such as fruits, vegetables, milk, meat and fish has been increasing rapidly in the domestic as well as global markets (Kumar *et al.*, 2003; Aksoy, 2005). Further, with on-going process of market liberalisation and globalisation the domestic as well as global markets are moving towards integration. The NER has a congenial agro-climatic environment[2] favouring cultivation of a variety of seasonal and off-season vegetables, fruits, flowers, spices,

*National Centre for Agricultural Economics and Policy Research (NCAP), Pusa, New Delhi - 110 012 and †International Food Policy Research Institute (IFPRI), New Delhi Office, DPS Marg, Pusa, New Delhi - 110 012, respectively.

and aromatic and medicinal plants (Asati and Yadav, 2004; Nakro and Khiki, 2006). Thus, the region has the potential to leapfrog from the existing subsistence agriculture to a commercial one through agricultural diversification. But, the congenial environment could not be utilised to harness the huge untapped potential due to a number of operational constraints.

Diversification-led growth is expected to generate enormous income and employment opportunities for the farmers, especially smallholders and rural labourers. Majority of high-value commodities especially vegetables are labour-intensive, have a low gestation period and generate quick and higher returns per unit of land and labour (Barghouti *et al.,* 2005; Weinberger and Lumpkin, 2005; Sharma, 2005; Joshi *et al.,* 2006). But, high-value agriculture requires more capital, improved technologies, quality inputs and better support services. Lack of access to these may constrain small farm diversification. Most high-value commodities are perishable and need immediate transportation from production to consumption centres and/or markets. Alternatively, these need to be stored or processed into less perishable forms. Rural markets for high-value commodities are thin and marketed surplus of smallholders is usually too small to economically trade in distant urban markets due to high transportation costs (Birthal *et al.*, 2005).

The main objectives of this paper are to examine (i) the status of agricultural diversification and its role in speeding up agricultural growth, (ii) the participation of smallholders in agricultural diversification towards high-value crops on different farm categories, and (iii) the driving forces that enable the producers to harness the potential of high-value agriculture. The paper builds on the hypotheses that diversification towards high-value commodities has considerable potential to accelerate agricultural growth and augment income and employment opportunities for the farmers especially smallholders. The paper proceeds as follows. The next section describes data and methods used to test the stated hypotheses. Section III discusses the status and contribution of diversification to agricultural growth. Some relationships between diversification and farm size are explored in Section IV. Section V identifies the factors promoting/retarding agricultural diversification. The conclusions and policy implications are discussed in the last section.

II

DATA AND METHODOLOGY

Diversification can be defined as a movement of resources from one agri-enterprise to another or a larger mix of enterprises considering their likely risks and returns leading to a production portfolio that minimises risks and increases income (Joshi *et al*., 2004). In this paper, we treat diversification as a shift of resources from low-value staples to high-value enterprises (crops), and measure it as the share of crop 'i' in the gross cropped area and/or value of output of agriculture.

To look into whether agriculture in the NER is diversified or diversifying we use data from several published and unpublished sources. The nature and extent of diversification are examined using information on the value of agricultural commodities from the National Accounts Statistics of the Central Statistical Organisation (CSO), Ministry of Statistics and Programme Implementation, Government of India (GOI, various years).

The pattern of diversification is studied by examining the shares of high-value crops in the gross value of output of agriculture and trends therein. The contribution of different crops or for that matter high-value crops to overall growth in agriculture is estimated as the sum of annual changes in the value of output of crop 'i' (from year t to t+1) divided by the sum of changes in the value of output of all crops or agriculture sector.

$$S_i = \sum_{t=1}^{T} VOP_{it} \bigg/ \sum_{t=1}^{T} \sum_{i=1}^{n} VOP_{it}$$

where S_i is the share of crop 'i' in the overall growth of agriculture, and ΔVOP is the change in value of output of crop i (i=1 to n) from year t to t+1(t= 1 to T).

The relationship between diversification and farm size is examined using household level data from the 54th Round survey conducted by the National Sample Survey Organisation (NSSO) of Ministry of Statistics and Programme Implementation, Government of India (Government of India, 1999). The survey was conducted in 1998, and provides information on the cropping pattern and cultivation practices of nearly 50,000 farm households spread across the country including the north eastern states. The survey also contains information on several other variables like household size, occupation structure, irrigation sources, and access to institutional credit. These were used to explain households' decisions to diversify towards high-value crops that is, fruits and vegetables.

A logit model was estimated to identify the factors that influence household's decision to grow high-value crops (fruits and vegetables). The dependent variable is binary taking a value of 1 for the growing household, 0 otherwise.

$$P_i = E(Y = 1/X_i) = 1/1 + e^{-(\beta_1 + \beta_i X_i)}$$

where P_i is the probability that Y =1, that is, the household grows fruits and vegetables. X_is are the factors that influence household's decision to grow these crops. e is the base of the natural logarithm, and β_is are the coefficients of the explanatory variables, X_is.

III

PATTERN OF AGRICULTURAL DIVERSIFICATION

The agricultural sector, comprising crops, livestock and fisheries contributes about 30 per cent to the agricultural gross domestic product in the NER. Crop segment (agriculture) however dominates the sector with a share of 79 per cent in triennium ending (TE)[3] 2002-03 (Table 1). Livestock is the next most important component, followed by fisheries.

TABLE 1. COMPOSITION AND GROWTH OF AGRICULTURAL SECTOR IN THE NER

				(per cent)
Period	Crops	Livestock	Fisheries	Total
(1)	(2)	(3)	(4)	(5)
	Share in total value of output			
TE 1982-83	80.1	14.6	5.3	100.0
TE 1992-93	76.9	17.9	5.2	100.0
TE 2002-03	78.9	16.5	4.6	100.0
	Annual Growth			
1980-81 to 1991-92	2.6	5.8	2.0	3.1
1992-93 to 2002-03	3.2	2.1	0.7	2.9

Source: Government of India (various years).

The composition of agricultural sector has not changed much over the last two decades. The share of crops declined by 3.2 percentage points between TE 1982-83 and TE 1992-93 mainly due to rise in the share of livestock. During this period, livestock production grew faster than the other segments. In the subsequent period, while there was a significant deceleration in the growth of livestock and fish production, growth in agriculture accelerated from 2.6 per cent to 3.2 per cent. On the whole, agricultural sector in the region grew consistently at a rate of about 3 per cent a year.

Since the crop segment emerged as the main driver of growth in the last decade it is of interest to examine the relative contributions of different crops or crop groups to the growth in agriculture. In terms of acreage, cereals, mainly rice, dominate agriculture occupying 67 per cent of the gross cropped area; their share however has declined from 72 per cent in the early 1980s.

In value terms, the situation, however, is quite different (Table 2). In TE 2002-03 cereals accounted for one-third of the value of output of agriculture, down from 39 per cent in TE 1982-83. The decline in their share was drastic since the early 1990s. The share of sugar and fiber crops has been declining consistently, and the share of pulses and oilseeds has remained almost unchanged.

High-value crops[4] (fruits and vegetables, spices and condiments, and drugs and narcotics) registered a significant increase in their shares during this period. Fruits and vegetables emerged as the largest crop group with a share of 35 per cent in the value of agriculture output in TE 2002-03. Between TE 1982-83 and TE 2002-03 their share improved by 9 percentage points. The share of condiments and spices

improved consistently from 8 per cent to 10 per cent during this period, while the share of drugs and narcotics (mainly tea) remained almost unchanged at 11 per cent. Together high-value crops accounted for about 57 per cent of the output of agriculture in TE 2002-03, rising from about 46 per cent in TE 1982-83.

TABLE 2. SHARE OF HIGH-VALUE CROPS IN AGRICULTURE OUTPUT AND GROWTH IN NER

(per cent)

Commodities	Share in value of output			Annual growth		Share in growth	
	TE 1982-83	TE 1992-93	TE 2002-03	1980-81 to 1991-92	1992-93 to 2002-03	1980-81 to 1991-92	1992-93 to 2002-03
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cereals	39.3	37.7	33.4	1.9	2.0	31.6	23.3
Pulses	1.3	1.6	1.5	4.8	2.3	2.7	1.4
Oilseeds	3.0	4.0	3.5	6.5	1.9	7.7	2.1
Fibers	2.0	1.4	0.8	-2.3	-2.4	-1.0	-0.4
Sugarcane	3.5	1.8	0.9	-3.9	-4.6	-3.3	-1.7
Fruits and vegetables	25.9	29.4	35.0	4.0	5.1	40.0	49.0
Condiments and spices	8.2	9.1	10.4	4.6	4.8	12.5	13.4
Drugs and narcotics	11.5	10.9	11.3	2.2	2.8	9.7	11.8
Other crops and byproducts	5.5	4.1	2.4	-0.03	1.6	0.0	1.2
Total	100.0	100.0	100.0	2.6	3.2	100.0	100

Source: Government of India (various years).

Despite a decline in their share, cereals maintained their growth momentum of about 2 per cent a year since 1980-81. Oilseeds and pulses were the fastest growing segments during 1980-81 to 1991-92, but subsequently there was a significant deceleration in their growth. Growth in sugarcane and fiber crops remained negative throughout. However, as expected fruits and vegetables experienced a robust growth during both the periods. So were the condiments and spices. In fact, in the latter period these crops emerged as the fastest growing segments of agriculture in the region. Drugs and narcotics also experienced acceleration in growth.

Table 2 also presents the contribution of different crops/crop groups to overall growth in agriculture. The share of cereals in agriculture growth declined from 32 per cent during 1980-81 to 1991-92 to 23 per cent during 1992-93 to 2002-03, and the share of oilseeds and pulses fell drastically. Fruits and vegetables were the main drivers of growth in agriculture in both the periods. These accounted for 49 per cent of the growth during 1992-93 to 2002-03, up from 40 per cent during 1980-81 to 1991-92. The contribution of condiments and spices and drugs and narcotics also improved but marginally. Together high-value crops contributed 62 per cent to agriculture growth during 1980-81 to 1991-92 and 75 per cent during 1992-93 to 2002-03.

The agro-climatic conditions in the NER are favourable to cultivation of a number of high-value crops, and given the adequate production, market and processing support, these crops can speed up agricultural growth. High-value agriculture in the region is by and large organic in nature as the use of agrochemicals

is extremely low. Fertiliser use in vegetables and fruits is limited to 32 and 11 per cent of the growers respectively (Government of India, 1999). Pesticides are also not used much; only 28 per cent vegetable growers and 10 per cent fruit growers use pesticides. The low use of agrochemicals is an opportunity for the region to encash the growing market for organic foods in the western countries. Besides, there are also opportunities in the domestic market especially among high-income segments.

IV

FARM SIZE AND DIVERSIFICATION

High-value crop production is labour intensive and generates quick and higher returns. Based on farm surveys in Himachal Pradesh, Sharma (2005) estimated labour use in vegetables between 126-400 man-days/ha, as compared to 78-153 man-days/ha in cereals. The net returns from vegetables ranged from Rs. 2,020 to Rs. 6,040/tonne while the net returns from cereals were negative. The question is: can smallholders diversify towards high value crops given the limitation of land and their household food security concerns? Most of the high-value crops require more capital, quality inputs, improved technologies, better information and support services, and smallholders often lack access to these. Production and market risks are also higher in high-value crops (Joshi *et al.,* 2006). Rural markets for these commodities are thin while the marketed surplus of smallholders is too small to trade remuneratively in the distant urban markets. Thus, lack of economies of scale and limited access to markets can deter small farm diversification. In this section we examine the issues of farm size and diversification focusing on horticultural crops.

As elsewhere in the country, smallholders dominate agriculture in the NER also (Table 3). Over 86 per cent of the holdings are small (≤2ha). Further disaggregation shows the dominance of sub-marginal (≤0.5ha) and marginal (0.5-1.0) farms in the region. Over 31 per cent farms are sub-marginal and share 7 per cent of the arable land. The marginal farms comprise 29 per cent with a share of 20 per cent in arable land. It is thus, apprehended that such tiny farms would no longer be economically viable based on the cultivation of staples alone. Diversification towards high-value crops is considered as an important strategy to improve their viability, provided arrangements are made for market access.

TABLE 3. DISTRIBUTION OF LAND HOLDINGS IN NER, 1998

Farm size	Share in holdings (per cent)	Share in area (per cent)	Size of land holding (ha)
(1)	(2)	(3)	(4)
Sub-marginal (>0.002 - 0.5 ha)	31.4	7.4	0.3
Marginal (0.5-1.0 ha)	29.1	19.8	0.8
Small (1.0-2.0 ha)	25.9	33.2	1.5
Semi-medium (2.0-4.0 ha)	10.8	25.7	2.7
Medium (4.0-10.0 ha)	2.7	13.1	5.4
Large (>10.0 ha)	0.1	0.8	15.5
All	100.00	100.00	1.1

Source: Government of India (1999).

The farmers' participation in fruits and vegetables production is examined in terms of the proportion of households growing these crops and their area share. Table 4 presents this information. On an average, 67 per cent of the households in the NER grow vegetables and 5 per cent grow fruits. The participation rate in vegetable production increases with farm size. However, the participation rate of smallholders is much closer to the regional average. The participation rate in fruit production is the lowest among the large farmers, followed by sub-marginal farmers. For others, it is almost the same.

Table 4 also presents the share of fruits and vegetables in total cropped area by farm size for the growing households. On an average, 18 per cent of the area is allocated to vegetables and 1.3 per cent to fruits. The pattern of area allocation to fruits does not differ much across farm categories, except on large farms where the proportion of area under fruits is the least. For vegetables, the relationship with farm size is distinctly negative. On sub-marginal farms, vegetables occupy over 44 per cent of the area compared to 11 per cent on large farms. On other farm holdings, it ranges from 13 to 21 per cent.

TABLE 4. HOUSEHOLDS GROWING FRUITS AND VEGETABLES AND THEIR PATTERN OF
AREA ALLOCATION, 1998

							(per cent)
Crop (1)	Sub-marginal (2)	Marginal (3)	Small (4)	Semi-medium (5)	Medium (6)	Large (7)	All categories (8)
Households growing fruits and vegetables							
Vegetables	68.0	61.6	66.9	75.9	74.2	86.8	66.9
Fruits	3.1	5.1	5.5	6.1	5.0	1.2	4.7
Area under fruits and vegetables							
Vegetables	44.5	21.3	17.6	13.2	12.9	11.2	18.0
Fruits	1.2	1.3	1.3	1.3	1.4	0.2	1.3
Cereals	43.9	64.7	71.5	73.8	70.5	63.3	69.0
Pulses	2.3	4.2	3.4	4.2	4.5	2.3	3.8
Oilseeds	0.8	2.7	1.4	0.8	0.3	0.2	1.3
Sugarcane	0.2	0.6	0.4	0.9	0.4	0.0	0.6
Others	7.1	5.2	4.4	5.8	10.0	22.8	6.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Government of India (1999).

These results clearly reveal that smallholders do participate in high-value agriculture and allocate a larger proportion of area to high-value crops especially vegetables. This is expected, as most vegetables have a short production cycle and generate quick returns. Besides, smallholders have sufficient endowment of labour to cultivate labour-intensive crops like vegetables. The cultivation of fruits is also

labour-intensive, but its initial capital requirement is higher, and the gestation period is longer that discourage farmers to undertake cultivation of such crops.

Cultivation of fruits and vegetables though widespread on small farms, their scale of production is much smaller compared to others (last row of Table 5). On an average, the sub-marginal farmers allocate 0.08 ha of area to vegetables and fruits, and marginal farmers 0.12 ha. This is much less compared to 0.77 ha by large farmers and 0.61 ha by medium farmers. This gives an impression that smallholders cultivate these crops to meet their household consumption requirement. To investigate this, we classified farmers by percentage area allocated by them to these crops (Table 5). Amongst sub-marginal farmers 61 per cent allocate over 40 per cent of their area to vegetables and fruits, and another 19 per cent allocate between 20-40 per cent. The proportion of producers allocating over 40 per cent area to vegetables and fruits declines steeply with increase in farm size. However, the proportion of farmers allocating between 20-40 per cent area to these crops is higher among marginal and small farmers. Amongst large farmers, an overwhelming majority (94 per cent) allocate less than 20 per cent area to fruits and vegetables. These findings imply that a majority of the farmers including smallholders grow fruits and vegetables not only to meet their household consumption requirement, but also for the market.

TABLE 5. DISTRIBUTION OF FRUIT AND VEGETABLE GROWERS BY SCALE OF PRODUCTION, 1998

Per cent area (1)	Sub-marginal (2)	Marginal (3)	Small (4)	Semi-medium (5)	Medium (6)	Large (7)	All categories (8)
≤20	20.0	55.8	68.2	75.9	78.9	94.4	50.9
20-40	19.3	31.0	20.4	14.3	14.4	5.6	21.9
>40	60.7	13.2	11.4	9.8	6.7	0.0	27.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Area (ha)	0.08	0.12	0.19	0.32	0.61	0.77	0.16

Source: Government of India (1999).

Given the dominance of smallholders in agriculture and proportionately their higher area allocation to fruits and vegetables, it is expected that they make sizeable contribution to the total production of fruits and vegetables. As such, 69 per cent of the vegetable area and 55 per cent of the fruit farms in the NER is concentrated among smallholders (≤2.0 ha). These figures are as high as their share in arable land. Assuming that productivity is scale neutral, the area shares can be considered as their contribution to production. This, however, could be an underestimate if the productivity on small farms is higher, which is likely. It may be noted that there is sufficient empirical evidence indicating higher productivity on small farms in developing countries (Fan and Chang-Kang, 2005).

V

DETERMINANTS OF DIVERSIFICATION TOWARDS HIGH-VALUE CROPS

The farmers' decisions to diversify towards high-value crops are influenced by a number of household-specific factors and the surrounding socio-economic environment. In this section we examine the influence of such variables in farmers' diversification decisions using household level information from NSSO data set. We estimate a logit model where the dependent variable is binary taking a value of 1 if a farmer grows fruits and vegetables, zero otherwise. The explanatory variables include farmer's experience and management skills, occupation, land and labour endowments, and access to irrigation, credit and markets. The rationale for including these variables in the model is briefly described below.

Literature suggests experience, managerial skills, knowledge and information as the important factors in farmers' diversification decisions (Ahmad and Isvilanonda, 2003). We consider age of the head of the household as a proxy for such variables, and expect to have a positive influence on his decision to grow high-value crops. The gender of the head of the households can also influence diversification decisions because of trade-off in labour allocation by women between household chores and high-value crops (von Braun, 1995). Further, it is hypothesised that households with main occupation other than agriculture are less likely to grow fruits and vegetables because of time constraint and lack of skills. Land and labour are the two important factors in farmers' decision to diversify towards high-value crops. Farm size may have both a positive and negative influence. Large farmers may put larger area under high-value crops, while land could be an important constraint on small farm diversification. But, sufficient availability of labour with smallholders may encourage them to go for high-value crops, compared to labour constrained large land farmers. Family size in relation to size of land holding is taken as a proxy for labour availability. High-value crops, especially vegetables require a sustained supply of water for irrigation. Thus, farmers having access to regular irrigation water sources such as tubewell/pumps are expected to participate more in high-value agriculture. The capital requirement of high-value crops especially fruits is also higher, and capital-constrained farmers may not opt for cultivation of such crops.

Access to markets is one of the most important determinants of diversification towards high-value crops, as these are perishable and require immediate transportation to consumption centres/markets. Lack of transport infrastructure increases the cost of transfer of the produce from rural to urban markets as well as cost of acquisition of inputs, information and technology (Nakro and Khiki, 2006). A variable 'road density' in the district where a farmer is located has been introduced in the model to capture the effect of such factors on diversification. Finally, agriculture in India is a state subject and agricultural policies vary from state to state. State dummies were included in the model to delineate the state-specific effects.

The results of the logit model are given in Table 6. The coefficient of labour is positive and significant at less than 1 per cent, supporting the hypothesis that high-value agriculture is labour intensive and tends to be concentrated among the households having sufficient supply of family labour. Further, the occupation of the household has also a significant role in the process of diversification. The coefficient of occupation is positive and significant indicating that the tendency to grow high-value crops is stronger among the households primarily engaged in agriculture. This is expected as these households have a comparative advantage of experience and skills needed in agriculture over those whose primary occupation is not agriculture. The effect of other demographic variables, viz., age and gender is not significant.

TABLE 6. RESULTS OF THE LOGIT REGRESSION

Explanatory variables	Coefficient	Standard error
(1)	(2)	(3)
Age of the head of the household (years)	0.0011	0.0025
Gender of the head of the household,	-0.0659	0.1223
Male =1, otherwise =0		
Main occupation of the household,	0.2227***	0.0686
Agriculture=1, otherwise=0		
Labour availability (Family members/ha of land possessed)	0.0139***	0.0026
Farm size,		
Sub-marginal =1, otherwise =0	-1.0694	0.8001
Marginal =1, otherwise =0	-1.1026	0.7977
Small =1, otherwise =0	-0.8915	0.7972
Semi-medium =1, otherwise =0	-0.5769	0.7991
Medium =1, otherwise =0	-1.0453	0.8058
Access to irrigation		
Surface irrigation=1, otherwise =0	0.0738	0.0820
Tubewell/pump irrigation =1, otherwise =0	0.3948***	0.1501
Access to institutional credit =1, otherwise=0	0.0372	0.2184
Road density (km/100 sq.km)	0.0145***	0.0026
Constant	0.2230	0.8623
Log-likelihood	-3589.11	
Chi-squared	931.72***	
Number of observations	6879	

   *** Significant at 1 per cent level.

Irrigation appears as a significant determinant of diversification, as the coefficient of both surface and tubewell irrigation is positive. However, it is significant only for tubewell/pump irrigation. In other words, investment in tubewell/pump irrigation is likely to accelerate the pace of diversification in the region. It may be noted that the region is endowed with basins of rivers like Brahmaputra and receives a considerable amount of rainfall. This potential, however, remains untapped (Government of India, 2001).

Coefficient on road density is positive and highly significant, indicating that high-value agricultural production is more concentrated in areas with better road network, and improving road network will accelerate the pace of diversification. It may be noted that most states in the region have a poor transport infrastructure,

raising the cost of transfer of produce from production to consumption centre. Nakro and Khiki (2006) estimated the transportation cost of fruits and vegetables in Nagaland between 18-28 per cent of the total cost. Thus markets and roads are important for diversification towards high-value crops.

Access to farm households to institutional credit though positively influences the farmers' decisions to diversify, but not significantly. Nevertheless, the density of institutional credit in the NER is low. In 2001-02 the region shared only 0.5 per cent of the total credit disbursed to the agricultural sector in the country (Reserve Bank of India, 2004), which translates into Rs. 650/ha of the net sown area. This is much lower than the national average of Rs. 3,450/ha. Thus, improving farmers' access to institutional credit is important to facilitate the process of diversification.

The effect of farm size on diversification, as expected is insignificant implying that high-value agriculture in the region is not confined to any specific farm group and is practiced by all categories of farmers.

In sum, smallholders do participate in high-value agriculture, and inspite of scale limitation, make significant contribution to high-value agricultural production. They have the potential to diversify more and produce efficiently compared to large producers because of the availability of sufficient labour of low opportunity cost with them. But, they need better access to markets, inputs, technology, credit and information to expropriate the opportunities being created by their expanding demand.

VI

CONCLUSIONS AND POLICY IMPLICATIONS

The north eastern region has congenial agro-climatic environment for growing a number of high-value crops. The region can emerge as an important centre of high-value agriculture considering rapidly rising demand for high-value products. Rapid growth in high-value agriculture will accelerate the overall growth of agricultural sector and benefit a large number of poor smallholders. Ravallion and Datt (1996), Thirtle *et al.*, (2002) and Warr (2003) have shown that in developing countries where a sizeable proportion of the population depends on agriculture, growth in agricultural sector has a more favourable effect on poverty reduction than the growth in other sectors of the economy.

Notwithstanding favourable climatic conditions, upscaling of high-value agriculture in the region is constrained by a lack of infrastructure for production, marketing and processing. Sustained supply of irrigation water is crucial to improving production and productivity of high-value, but only about 10 per cent of the total cropped area in the region is irrigated (FAI, 2003).The region has considerable surface and ground water resources because of its location in high rainfall zone (Government of India, 2001), but remain untapped due to uneven topography and difficulty in construction of reservoirs. Watershed programmes may

be initiated to conserve and harvest water to exploit fully the existing water resources.

Lack of infrastructure and markets is an important impediment in realising the potential of high-value agriculture in the region. Local markets for high-value food commodities are thin, and transport, cold storage and processing infrastructure is poor. Road network is poor in most of the states in the region. The road density ranges between 168-490 km/1000 sq.km. except in Assam, Nagaland and Tripura which have comparatively a much better road network (Government of India, 2006). The situation warrants greater investment in roads and transportation, and development of innovative market institutions like co-operatives, self-help groups and contract farming that provide an assured market to the producers, quality inputs, technology and credit. High-value agriculture in the region, by and large, is characterised by organic agriculture, and growing markets for organic foods in the western countries as well as in the domestic high income segment offer a scope for the region to harness this opportunity. The NER has high potential to tap the immense opportunities emerging in high-value sector provided the existing constraints are alleviated through appropriate policies and institutional arrangements.

NOTES

1. North eastern region includes states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura.

2. The climate of the region varies from sub-tropical to extreme alpine type. The normal temperature varies between 18^0C to 32^0C during summer and from 0^0C to 22^0C during winter. The region receives maximum rainfall in the country and varies from 1400 mm to as high as 6000 mm across states.

3. TE stands for triennium ending average.

4. Banana, pineapple, jackfruit, citrus, pears and coconut are important fruits in the north eastern region. The important vegetables include potato, onion, peas, cabbage, ladyfinger and cauliflower. Arecanut, ginger, chilies, coriander, turmeric and garlic are important spices.

REFERENCES

Ahmad, A. and S. Isvilonanda (2003), "Rural Poverty and Agricultural Diversification in Thailand", Paper presented at the Second Annual Conference of Swedish School of Advanced Asia and Pacific Studies (SSAAP), Lund Sweden, October 24-26.

Aksoy, M.A. (2005), "The Evolution of Agricultural Trade Flows", in M...A. Aksoy and J.C. Beghin (Eds.) (2005), *Global Agricultural Trade and Developing Countries,* The World Bank, Washington, D.C., U.S.A.

Asati, B.S. and D.S. Yadav (2004), "Diversity of Horticultural Crops in North Eastern Region", *Himalayan Ecology*, Vol. 12, No.1.

Barghouti, S., S. Kane, K. Sorby and M. Ali (2005), *Agricultural Diversification for the Poor: Guidelines for Practitioners,* Agriculture and Rural Development Discussion Paper 1, The World Bank, Washington, D.C., U.S.A.

Birthal, P.S., P.K. Joshi and Ashok Gulati (2005), *Vertical Coordination in High-value Food Commodities: Implications for Smallholders,* Discussion Paper 85, Markets, Trade and Institutions Division, International Food Policy Research Institute, Washington, D.C., U.S.A.

Fertiliser Association of India (FAI) (2003), *Fertiliser Statistics*, New Delhi.

Fan, S., and C. Chang-Kang (2005), "Is Small Beautiful? Farm Size, Productivity and Poverty in Asian Agriculture", *Agricultural Economics*, Vol. 32, No.1, pp.135-146.

Government of India (GOI), (1999), *Cultivation Practices in India,* National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, New Delhi.

GOI (2001), *Report of the Working Group on Agricultural Development in East and North Eastern India*, Planning Commission, New Delhi.

GOI (2006), *Annual Report 2005/06*, Ministry of Development of North Eastern Region, New Delhi.

GOI (various years), *Statewise Esimates of Value of Output from Agriculture and Livestock*, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, New Delhi.

Joshi, P.K., A. Gulati, P.S. Birthal and L. Tewari (2004), "Agriculture Diversification in South Asia: Patterns, Determinants and Implications", *Economic and Political Weekly*, Vol.39, No.24, June 12, pp. 2457-2467.

Joshi, P.K., Laxmi Tewari and P.S. Birthal (2006), "Diversification and its Impact on Smallholders: Evidence from a Study on Vegetable Production", *Agricultural Economics Research Review*, Vol. 19, No.2 (forthcoming).

Kumar, P., Mruthyunjaya, and P.S. Birthal (2003), "Changing Consumption Pattern in South Asia", Paper presented at FICCI-ICRISAT-IFPRI International Workshop on "Agricultural Diversification and Vertical Integration in South Asia" New Delhi, November 5-6.

Nakro, V. and C. Khiki (2006), "Strengthening Market Linkages for Women Vegetable Vendors: Experiences from Kohima, Nagaland India", in R. Vernooy (Ed.) (2006), *Social and Gender Analysis in Natural Resource Management- Learning Studies and Lessons from Asia*, Sage Publications India Pvt. Ltd., New Delhi.

Ravallion, M. and Gaurav Datt (1996), "How Important to India's Poor is the Sectoral Composition of Growth in India", *World Bank Economic Review*, Vol.10, pp.1-25.

Reserve Bank of India (RBI) (2004), *Report of the Advisory Committee on Flow of Credit to Agriculture and Related Activities from the Banking System*, Mumbai.

Sharma, H.R. (2005), "Agricultural Development and Crop Diversification in Himachal Pradesh: Understanding the Patterns, Processes, Determinants and Lessons", *Indian Journal of Agricultural Economics*, Vol. 60, No.1, January-March, pp. 71-93.

Thirtle, C., Lin, L. and J. Piesse (2002), *The Impact of Research-led Agricultural Productivity Growth on Poverty Reduction in Africa, Asia and Latin America*, Research Paper 016, Kings College, University of London, pp 1-26.

von Braun, J. (1995), "Agricultural Commercialization: Impacts on Income and Nutrition and Implications for Policy", *Food Policy*, Vol. 20, No. 3, pp. 187-202.

Warr, P.G. (2003), "Poverty and Economic Growth in India", in K. Kalirajan and U. Sankar (Eds.) (2003), *Economic Reforms and the Liberalization of the Indian Economy*, Edward Elgar, Cheltenham, U.K., and Northampton, MA, U.S.A.

Weinberger, K. and T.A. Lumpkin (2005), *Horticulture for Poverty Alleviation: The Unfounded Revolution*, AVRDC Working Paper No. 15, AVRDC-World Vegetable Center, Shanhua, Taiwan.