CHAPTER EIGHT

SUMMARY OF FINDINGS AND CONCLUSION

8.1 This concluding chapter is meant for drawing the overall conclusion from the study and extracting the policy implications thereof. To facilitate such inferencing the broad findings of the study have been recapitulated in the following section.

8.2 Recapitulation of Broad Findings of the Study

8.2.1 Cropping Pattern Changes in Assam:

• The cropping pattern in Assam is largely dominated by food grains with a share of more than two third of the total cropped area. Winter paddy has traditionally been the most popular crop in the state. This is followed by autumn paddy and summer paddy. Among the non-food grains oilseeds have the largest acreage share.

• There has been a shift in the cropping pattern in Assam away from cereals and food grains to non-cereals and non-food grains during the study period.

• There has been an increase in acreage share of winter paddy and summer paddy whereas that of autumn paddy has declined during 1998-99 to 2007-08. However, during the entire study period of 1991-92 to 2007-08 (without taking vegetables) acreage share of summer paddy increased by around 6% whereas the same in case of autumn paddy and winter paddy declined by around 8% and 3% respectively. Pulses also lost area share during the same period.

• Among the non-food grains oilseeds, jute and sugarcane have lost their respective shares in total cropped area. On the other hand, spices and vegetables have shown an increase in their acreage share.
8.2.2 Spatial and Temporal Variations in Cropping Pattern in Assam:

- There has been a marked shift in the cropping pattern across Assam away from food grains to non-food grains during the entire study period. However, within these crop groups the changes in the area shares of individual crops do not have a uniform pattern.

- An interesting feature of cropping pattern changes can be observed in that summer paddy has become more popular over the years in all the agro-climatic zones during the study period. On the other hand, while autumn paddy has lost acreage share in all the zones winter paddy has experienced a decline in acreage share in all but Central Brahmaputra Valley Zone and Upper Brahmaputra Valley Zone.

- Among the non-food grains whereas spices have registered an increase oilseeds, especially rapeseed and mustard, and jute have experienced a decline in their respective shares in total cropped area. The share of potato in total cropped area has increased in all except Hill Zone whereas sugarcane has gained area share in Lower Brahmaputra Valley Zone, North Bank Plain Zone and Hill Zone.

- However, during 2003-04 to 2007-08 after incorporating vegetables into analysis it has been found that the changes in the acreage distribution across not only crop groups but also individual crops show irregular patterns among the zones.

- The acreage share of cereals and total paddy has declined in all zones except Central Brahmaputra Valley Zone. Autumn paddy has gained acreage share in Barak Valley Zone and Hill Zone whereas a similar pattern was observed in case of winter paddy in Central Brahmaputra Valley Zone, North Bank Plain Zone and Upper Brahmaputra Valley Zone.
The acreage share of summer paddy has increased in all but Hill Zone. On the other hand, pulses have registered an increase in acreage in all the zones except Upper Brahmaputra Valley Zone.

- Oilseeds in general and rapeseed and mustard in particular lost area share in all but Barak Valley Zone and Hill Zone. There has been a decline in the acreage share of potato in case of Barak Valley Zone, Lower Brahmaputra Valley Zone and Upper Brahmaputra Valley Zone. Likewise sugarcane has experienced a decline in acreage share in Central Brahmaputra Valley Zone, North Bank Plain Zone and Hill Zone.

- An interesting aspect of the dynamics of cropping pattern as found from the study is that vegetables grown in both kharif and rabi seasons have experienced an increase in acreage share in all zones except Central Brahmaputra Valley Zone.

- As far as the growth rate of area of individual crops is concerned area under food grains has registered a negative growth rate in all zones except Barak Valley Zone and Hill Zone. Likewise cereals have a negative growth of area in all but Hill Zone. On the other hand, summer paddy and spices have a positive growth rate of area in all the zones. Likewise autumn paddy and jute have recorded a negative growth rate of area in all the zones.

- One interesting aspect of changes in the distribution of total paddy area among its seasonal varieties is the rise in the popularity of summer paddy among the farmers of the state.

8.2.3 Spatial and Temporal Variations in Crop Diversification in Assam:

- Like the state as a whole crop diversification shows an increasing trend in Lower Brahmaputra Valley Zone, North Bank Plain Zone and Hill Zone
during 1991-92 to 2002-03. However, during 2003-04 to 2007-08 taking vegetables into consideration diversification of crops has increased in all except Central Brahmaputra Valley Zone and Hill Zone.

* Only two zones, namely Central Brahmaputra Valley Zone and Lower Brahmaputra Valley Zone have levels of crop diversification higher than the state average during 1991-92 to 2002-03. Crop diversification was the highest in Central Brahmaputra Valley Zone till 1997-98 followed by Lower Brahmaputra Valley Zone, which has since then been surpassed by the later. North Bank Plain Zone had the highest level of crop diversification among the rest four zones, followed by Hill Zone. On the other hand, Barak Valley Zone had the lowest level of crop diversification for this entire sub-period except 1993-94.

* During the sub-period 2003-04 to 2007-08 Lower Brahmaputra Valley Zone has consistently experienced the highest level of crop diversification, followed by Central Brahmaputra Valley Zone except for the year 2007-08 when the later is surpassed by North Bank Plain Zone. On the other hand, Upper Brahmaputra Valley Zone had the lowest level of crop diversification except for the year 2006-07.

8.2.4 Variations in the Cropping Pattern among the Sample Farms:

* The cropping pattern in the sample farms is largely dominated by cereals and its major component paddy. Cereals have more than four fifth of total cropped area among the sample farms of Morigaon (84.86%), Cachar (83.87%) and Dibrugarh (81.88%). In sharp contrast to this, acreage share of cereals is around 52% in the sample farms of Dhubri, which is around 30% lower compared to the other districts.
Winter paddy has the highest acreage share in Dibrugarh (79.97%), followed by Cachar (77.40%), Morigaon (41.68%) and Dhubri (28.83%). Likewise a remarkable disparity can be observed in case of acreage share of summer paddy. Whereas the share of summer paddy in the total cropped area is the highest at around 43% in Morigaon followed by Dhubri at around 19%, the same in Dibrugarh is 1.57% and in Cachar less than 1%. Of the three seasonal varieties of paddy autumn paddy was least popular in terms of acreage share among the sample farms except that of Cachar district.

Among the non-cereals oilseeds have the highest acreage share in the sample farms of Dhubri (19.28%) and Dibrugarh (7.04%). The same for Morigaon and Cachar was 4.84% and 1.42% respectively.

Similarly, pulses have the largest share in total cropped area in Dhubri (7.58%) followed by Dibrugarh (7.04%) and the same is the lowest in Morigaon (0.30%).

A large disparity can also be observed in the acreage share of jute among the sample farms. Whereas jute is an important commercial crop in the sample farms of Dhubri and Morigaon with acreage shares of 12.19% and 6.57% respectively, it was not found to be cultivated at all by the sample farmers of Dibrugarh and Cachar districts.

Chilli has the highest acreage share in the sample farms of Cachar (4.47%), followed by Dhubri (2.4%), Dibrugarh (1%) and Morigaon (0.16%). Potato has more than 1% of total cropped area in Cachar (3.07%) and Dibrugarh (1.57%).

Among the vegetables winter vegetables are found to be more popular than summer vegetables in all but Morigaon district. It has the highest share in the sample farms of Cachar with around 6% of its total cropped area.
area. The same was the lowest in Morigaon (0.72%), followed by Dhubri and Dibrugarh with around 4% and 5% of the total cropped area respectively. On the other hand, summer vegetables have less than 1% of total cropped area in all but the sample farms of Morigaon.

8.2.5 Flood Proneness and Cropping Pattern in the Sample Farms:

- Irrespective of the districts under consideration in the Chronically Flood Prone areas the kharif crops, especially cereals have a relatively lower acreage share and rabi crops a higher share compared to Flood Free and Occasionally Flood Prone areas.

- In Dhubri district Chronically Flood Prone areas have a higher area shares under rabi crops and/or crop groups. Cereals have only around one third of total cropped area in Chronically Flood Prone areas compared to around two third of the same in Flood Free and Occasionally Flood Prone areas. Another interesting feature of the cropping pattern is that winter paddy is not found to be grown at all in Chronically Flood Prone areas whereas the same in Flood Free and Occasionally Flood Prone areas accounted for around 45% and 49% of total cropped area respectively. On the other hand, summer paddy which is grown in the rabi season has the highest share of 32.42% in the Chronically Flood Prone areas compared to 14.33% and 12.37% in Flood Free and Occasionally Flood Prone areas respectively. Similarly, jute and winter vegetables have the highest acreage share in Chronically Flood Prone areas.

- Paddy, especially summer paddy is found to be the only crop being grown by the sample farms in the Occasionally Flood Prone areas of Morigaon district. In such areas summer paddy has the major share of around three-fourth of total cropped area and the rest is being covered by winter paddy.
In the Chronically Flood Prone areas summer paddy has around 50% of its total cropped area, followed by winter paddy (30.33%), oilseeds (12.85%) and jute (2.27%). Other important crops with more than 1% of total cropped area are potato (1.85%) and winter vegetables (1.21%). On the other hand, in the Flood Free areas the largest acreage share is being taken by winter paddy with around 70% of total cropped area. This is followed by jute (18.84%), summer vegetables (4%).

* In Dibrugarh winter paddy is the only seasonal variety of paddy being cultivated in the Flood Free areas with around 97% of its total cropped area. Other important crop with more than 1% of total cropped area is winter vegetables (2.61%). Likewise winter paddy is the only seasonal paddy variety grown by the sample farms in Occasionally Flood Prone areas having an acreage share of around 76%. This is followed by oilseed (12.47%), pulses (6.59%), potato (2.37%) and winter vegetables. On the other hand, cereals have a relatively lower share (72.75%) in total cropped area in Chronically Flood Prone areas. Moreover, winter vegetables have the highest acreage share (11.12%) in Chronically Flood Prone areas. Other important crops in Chronically Flood Prone areas with more than 1% of total cropped area include oilseeds (7.85%), chilli (3.24%) and pulses (2.8%) and potato (2.24%).

* In the Occasionally Flood Prone areas of Cachar almost all its total cropped areas is taken by cereals whereas the same in Flood Free areas is almost 99% and the rest 1% is covered by winter vegetables. On the other hand, the Chronically Flood Prone areas are found to have a more diverse cropping pattern. In these areas around 55% of total cropped areas are covered by cereals. Among the non-cereals winter vegetables
(16.41%) is the most popular among the sample farms of such areas, which is followed by chilli (12.7%), potato (8.34%), oilseeds (4.07%) and pulses (3.13%).

8.2.6 Extent of Crop Diversification in the Sample Farms:

- The cropping pattern is most diversified among the sample farms of Dhubri followed by Morigaon, Cachar and Dibrugarh.
- As far as flood proneness is concerned Chronically Flood Prone areas are found to have the highest level of crop diversification.
- In Dhubri and Cachar districts the cropping pattern of Occasionally Flood Prone areas are the least diversified whereas Flood Free areas are found to have the lowest level of crop diversification in the sample farms of Dibrugarh and Morigaon districts.

8.2.7 Determinants of Crop Diversification:

- Flood proneness and the associated risk of crop failure have a positive impact on crop diversification.
- In case of diversification defined over area, flood free areas are the least diversified followed by occasionally flood prone areas. However, if diversification is defined over output value occasionally flood prone areas are found to be least diversified.
- Farm size, irrigation and access to formal credit have a positive impact on crop diversification.
- Use of high yielding varieties of seeds and size of the farm (cultivator) household has a negative impact on crop diversification.
8.2.8 Other Findings:

- Crop Diversification promotes marketing of output.
- Crop diversification plays an important role in enhancing farm income.
- Farm size and share cropping without cost sharing have a negative impact on income generation in the farms.

8.3 Overall Conclusions of the Study

The cropping pattern in Assam has shown considerable variations over time and space. There has been a shift in the acreage share from cereals and food grains to non-cereals and non-food grains. One interesting aspect of the trends in cropping pattern is that area share of summer paddy has increased over the years. On the other hand, the area shares of autumn paddy and winter paddy have a declining tendency. Similarly, among the non-food grains while importance of oilseeds in terms of acreage share has declined the same in case of spices and vegetables have increased over the years.

The temporal comparison of the cropping pattern shows an increase in the extent of crop diversification in the state. In the context of Assam's agriculture these changes in the cropping pattern and crop diversification can have several beneficial effects. Crop diversification, among other things, has led to enhancement of income generation in the farms. Through linkages with farm households agricultural workers are likely to find more work for more days in a year. Diversification into high value crops like vegetables, spices etc. can create conditions for secondary activities like storage, processing and marketing to emerge as significant business activities in rural and semi-urban areas. To take advantage of these activities a prior anticipation and preparedness will be necessary. This will not only enable potential entrepreneurs to take advantage of
these new opportunities but in turn give further momentum to diversification as the value chain for the crops will emerge.

Moreover, crop diversification has a special relevance in the flood prone areas of the state. In the chronically flood prone areas flood can be damaging and may limit the farm households from growing crops during kharif season. The study reveals that the farmers in such conditions have adopted crop diversification extensively to make the most of their land resources in the flood free rabi season. Thus crop diversification appears to be a strategy for countering the limits and damages imposed by flood where floods are almost regular and hence anticipated.

Identification of factors contributing to crop diversification is important for extracting policy implications. The study reveals that access to irrigation and institutional credit lead to a higher level of crop diversification.

8.4 Policy Implications
In view of the beneficial effects of crop diversification discussed above the agricultural policy in the state should be geared towards facilitation of crop diversification. Such policy will entail improving access to irrigation and credit for farmers and better market linkage from the rural economy.

As for a policy for improving access to irrigation, it is worth mentioning here that it is not merely a question of expanding irrigation capacity but also of fuller utilisation of existing capacity. Considering poor utilization of government irrigation schemes and relatively better efficiency in utilization of privately owned small scale shallow tube well based irrigation systems, future expansion of irrigation capacity in the state should put more emphasis on development of privately owned ground water based minor irrigation schemes (Dutta and
Bezbaruah, 2003). However, the main factor hindering full capacity utilization of STW based private irrigation projects in the state is fragmentation of holdings. Apart from undertaking appropriate land reform measures in this regard ground water market should be facilitated to ensure better utilization of irrigation capacity of STWs based irrigation schemes. Because the emergence of ground water market in certain areas has facilitated better utilization of irrigation potential of these schemes in spite of predominance of small and fragmented holding (Dutta and Bezbaruah, 2006).

Development of ground water based schemes, however, may not be possible in all the parts of the state due to specific geographical and geological conditions. For example, Barak Valley region of the state is poorly endowed with ground water resource and the Hills are not suitable for development of ground water based irrigation. Therefore, irrigation development in such areas has to be based on utilisation of available surface water resource such as river flow. Development of surface water based schemes will generally require comparatively larger initial investment and will have to be operated at a bigger scale than the ground water based shallow tube well schemes. Hence, government intervention will be necessary in this regard. Even if such irrigation capacity is installed under government sector, farmers' bodies should be involved in management of these projects so as to ensure their better efficiency in utilisation (Dutta and Bezbaruah, 2003).

However, as far as the chronically flood prone areas are concerned extending such facilities will entail a considerable challenge. It will be necessary to devise innovative delivery mechanism for the purpose. This can be a subject matter of another multidisciplinary study involving agricultural scientists and irrigation engineers.
Timely availability of institutional credit is very important to capacitate the farmers to move towards diversification of crops. The Government under the aegis of the Reserve Bank of India has already laid stress on financial inclusion. This has to be pursued more vigorously by implementing existing and unconventional steps like appointment of business representatives and banking correspondents, revamping micro finance institutions (MFIs) in a more transparent and effective manner apart from enabling regional rural banks (RRBs) and rural branches of scheduled commercial banks (SCBs) in operating more actively. The role of technological innovations is important in bringing down the dependency on informal sources of credit. These technological advancements should incorporate the features of informal agencies like suitability, timeliness, convenience, adequacy etc. that attract the poor (RBI, 2006). Introduction of smart cards will facilitate activation of this unconventional delivery mechanism of financial services in rural and far-flung areas.

Improving rural infrastructure in general and road connectivity in particular, by taking full advantage of centrally sponsored schemes like Pradhan Mantri Gram Sadak Yojana (PMGSY) and other policy initiative will give the necessary market linkage to the rural economy which will enable farmers to further diversify into high value crops. The process in turn can contribute significantly to improvement of overall productivity per hectare of agricultural land in the state.