CHAPTER VIII

SPATIAL VARIATION OF AGRICULTURAL DEVELOPMENT

Agricultural Development

Various aspects play their role in agricultural development of a region. A few such aspects include crop productivity, cropping pattern, crop diversification, cultivation of commercially important crops, advanced methods of agriculture, innovation in agriculture, nature of agrarian relations and maintenance of ecological balance and several others. Agricultural development includes both physical and non-physical factors. These factors are responsible for agricultural development as well as its spatial variation. The spatial characteristics of agricultural development can be represented by the help of maps. The method of mapping of spatial characteristics of the level of agricultural development provides a rational base for future orientation of agricultural planning. It can be used as an effective means for the delimiting agriculturally weaker areas where agrarian mechanization could not bring about remarkable changes and modification in crop structure and agricultural production.

Based on the conceptual framework of agricultural development, Bhagabati (1990) presented a model showing the process of interacting aspects like land use, cropping pattern, technification, ecology, agrarian relation and infrastructural and institutional factors. According to him, these aspects are highly interdependent and the status of any one of them generally depends more or less on the achievement of the others. These aspects vary over space either qualitatively or quantitatively or both.

While mapping the levels of economic development in India, Schwartzburg used agricultural indictors of crop productivity, that is average annual food production per capita or agricultural population, per acre yield of major food grain as percentage of national yield; agrarian relations such as agricultural labourers as percentage of rural
population, average annual wage per agricultural labour family and concentration ratio of landholding and institutional factor of members of agricultural credit societies per million of agricultural families (Schwartzburg, 1962). These indicators were not used to measure agricultural development but used to show economic development.

For measuring regional development of agriculture, Mitra (1967) used some indicators which included percentage of double cropped area as an expression of intensity of cultivation, percentage of gross irrigated area as a measure of agricultural inputs, area under cash crops signifying commercialization of agriculture and yield of clean rice indicating efficiency of agricultural practices. He also used other indicators to show degree of subsistence economy and to obtain an idea about land dependency of cultivators.

A composite index of agricultural development based on three factors the growth rate of agricultural output, the use of modern inputs in agriculture and the productivity per hectare was constructed by Nath (1969) to compare the level of agricultural development in various states of India. His was one of the few papers, which was directly concerned with the spatial pattern of agricultural development in India at the state level.

Sharma (1971), using detailed district wise data, studied agricultural development. He opined that agricultural development should be assessed not only by the levels of productivity or trends in agricultural production but also with reference to various physical inputs like irrigation, fertilizers, improved seeds and extent of cultivated area. He regionalized India on the basis of land resources and crop productivity index.

In the remarkably analytical study of levels of regional development in India, Raza (1978) took as many as 41 indictors of agricultural development grouped into four
subsets of productivity, production conditions, agrarian relations and change in agriculture.

From the discussion of the above mentioned works done by different authors, it is seen that various factors like crop productivity, degree of commercialization; agrarian relations, ecological balance, technification, agricultural land use, economic infrastructure, social amenities and attitude of social groups are used to identify agricultural development in a region.

In Darrang district of Assam, there is marked spatial variation in the level of agricultural development. The different community development blocks of the district are characterized with different level of development due to varied impact of physical, socio-economic, technological and organizational factors.

Increase in population as well as high physiological density (Chandna, 2000) exerts pressure to reuse the land, increase intensity of cropping to increase productivity and ultimately resulting in agricultural development. Therefore, in order to examine the disparity of agricultural development it is necessary to study the spatial variation of physiological density of population. From the table 8.1 it is observed that there is significant spatial variation in the physiological density in the district. From the values of physiological density three categories of physiological density regions have been identified. The density below 400 has been taken as low, between 400 – 700 as medium and above 700 as high. The values of physiological density derived as such are mapped (fig. 8.2) and this map, exhibits a spatial pattern of physiological density in the district. It is observed that Dalgaon – Sialmari and Bechimari development blocks are placed in ‘low’ physiological density group. Other four development blocks of the district namely Sipajhar, Pub-Mangaldai, Pachim-Mangaldai and Kalaigaon are characterized
by ‘medium’ level of physiological density. The development block Khairabari falls under ‘high’ physiological density group.

Intensity of cropping reflects both agricultural growth and commercialization that maintains a spectacular spatial difference in the district. In the table 8.1, it is seen that Dalgaon – Sialmari and Bechimari development blocks represent the highest index of cropping intensity (277.06 and 225 percent respectively) followed by Pub-Mangaldai, Kalaigaon, Khairabari, Sipajhar and Pachim Mangaldai development blocks. In the Dalgaon – Sipajhar and Bechimari development blocks, the intensity of cropping is the highest to meet the food demand.

Of all the indicators which are used to agricultural development, irrigation is the most important one. Since rainfall is unreliable in respect of timely incidence and amount, different types of irrigation facilities are necessary for the development of agriculture. It encourages the farmers to make cultivation more intensive and productive. The proportion of area under irrigation is uneven in the district. It is observed that the percentage of area under irrigation is the highest in Dalgaon – Sialmari and Bechimari development blocks (90.07 and 86.99 percent respectively). Other development blocks namely Pub-Mangaldai, Pachim-Mangaldai, Kalaigaon, Sipajhar and Khairabari have lower proportion of irrigated area to total cropped area, accounting 70.44, 70.22, 64.27, 30.13 and 13.63 percents respectively. Most of the people of Dalgaon – Sialmari and Bechimari development blocks are Muslims of immigrant origin. They use shallow tube wells in their cultivated land to produce both Rabi and Kharif crops. In the char areas of Pub-Mangaldai and Pachim-Mangaldai development blocks, the Muslim farmers of immigrant origin use shallow tube wells to produce Rabi crops.
The use of fertilizer is most important for development of agriculture. But the use of it varies spatially according to the physical, socio-economic, institutional and organizational factors. The percentage of area under total fertilizer is the highest inhabited development blocks. For example, highest percentage of fertilizer has been used in Dalgaon – Sialmari and Bechimari development blocks (95.93 and 93.44 percent to the total cropped area respectively). They use both bio and chemical fertilizers (74.20 percent) which represent a notable thrust towards raising productivity and modernization of agriculture. The percentage of area under fertilizer is 47.90, 83.91, 50.08, 72.21 and 16.49 to the total cropped area of Sipajhar, Pub-Mangaldai, Pachim-Mangaldai, Kalaigaon and Khairabari development blocks respectively. The use of bio and chemical fertilizer is taken into consideration to determine the composite index of agricultural development.

So far the use of the HYV rice such as Bahadur, Biplab, Ranjit, Masuri, IRRI etc. is concerned, it is seen that there is marked spatial variation across the district. The Kalaigaon development block records the highest proportion of HYV rice area to the total rice cropped area accounting for 21.48 percent, which is followed by Sipajhar (19.28 percent), Bechimari (17.75 percent), Dalgaon – Sialmari (16.31 percent), Pub-Mangaldai (12.93 percent), Pachim Mangaldai (10.01 percent) and Khairabari (2.23 percent) development blocks. The use of HYV rice depends upon the attitudes of farmers along with the ecological, climatic, soil, economic and technological conditions.

In the district of Darrang, there is spatial variation in the degree of crop diversification. Crop diversification analysis (table 8.1) indicates that Bechimari development block has the highest diversification of crops followed by Dalgaon – Sialmari, Pub-Mangaldai, Kalaigaon, Khairabari, Pachim-Mangaldai and Sipajhar
development blocks. In intensive agriculture, higher diversification of crops can also be considered as an indicator of the agricultural modernization, it may be noted that the Bechimari development block maintains a relatively higher block prospect. This development block is predominantly inhabited by Muslim farmers of immigrant origin.

The overall agricultural productivity index reveals interesting fact. The agricultural productivity index indicates that Dalgaon – Sialmari and Bechimari development blocks form the high productivity region. It may be noted that these two development blocks are predominantly inhabited by farmers of Muslim of immigrant origin who are traditionally very efficient in deriving maximum output from the cultivation. They are also industrious. They produce a variety of crops both in winter and summer seasons. On the other hand, Khairabari development block with low productivity index is predominately inhabited by indigenous Hindu people. Sipajhar, Pub-Mangaldai, Pachim-Mangaldai and Kalaigaon development blocks with moderate productivity index are inhabited by indigenous Hindu, Muslim, Scheduled Tribes and Caste and Muslims of immigrant origin people. In the char areas of this development origin produce different kinds of winter crops using irrigation facilities. It may be said that ethnic composition of the different social groups in different development blocks has some relationship with agricultural productivity.

The commercial crops cultivated by the different development blocks include vegetables, jute and potato. Infect, modern agriculture is based on commercial crops. It is seen that there is a spatial variation in the area of commercial crops in different development blocks of the district. The Dalgaon – Sialmari development block records the highest proportion of commercial crops area to total cropped area accounting for 43.70 percent, followed by Bechimari development block (37.70 percent). The area under commercial crop in Sipajhar development block is 9.26 percent to the total
cropped area. In Khairabari development block, the area under commercial crop is comparatively low with only 4.11 percent to the total cropped area. The percentage of area under commercial crops is 12.64, 5.25 and 13.32 in Pub-Mangaldai, Pachim-Mangaldai and Kalaigaon development blocks respectively. In Dalgaon–Sialmari and Bechimari development blocks, the Muslim farmers of immigrant origin produce a large number of commercial crops especially vegetables, by using irrigation facilities, fertilizer and other modern inputs. The vegetables produced in these two development blocks have been taken to other districts of Assam.

In regards to productivity of rice, it is observed that the development blocks of Kalaigaon, Sipajhar and Bechimari have relatively higher productivity. The highest productivity of rice is found in Kalaigaon (16380.18 quintal/hectares) development block, while lowest is recorded in Khairabari (1481.46 quintal/hectare) development block. In Sipajhar, Pub-Mangaldai, Pachim-Mangaldai, Dalgaon – Sialmari and Bechimari development blocks, the productivity of rice records 13965.21, 9966.96, 7807.89, 11974.72 and 12341.52 quintal/hectare respectively.

**Spatial Variation of Agricultural Development**

In studying the spatial variation of agricultural development, Z score method has been employed in the study area. Using 15 variables Z score is calculated for the analysis of spatial variation in agricultural development in the study area. The variables are

1. Intensity of cropping (X₁)
2. Percentage of HYV Rice to total rice area (X₂)
3. Percentage of area under cash crops to total cropped area (X₃)
4. Crop diversification index ranks ($X_4$)
5. Percentage of area under irrigation to total cropped area ($X_5$)
6. Agricultural productivity index ranks (Kendall method) ($X_6$)
7. Percentage of area under fertilizers to total cropped area ($X_7$)
8. Percentage of area under pesticides and insecticides to total cropped area ($X_8$)
9. Percentage of area under commercial crops to total cropped area ($X_9$)
10. Percentage of farm families using tractor ($X_{10}$)
11. Percentage of farm families using power tiller ($X_{11}$)
12. Percentage of farm families using Iron Plough ($X_{12}$)
13. Percentage of farm families using spray machines ($X_{13}$)
14. Percentage of farm families using shallow tube well ($X_{14}$)
15. Average size of land holdings ($X_{15}$)

The data matrix for the calculation of Z scores of spatial variation in agricultural development of the district Darrang is given on table 8.2. After processing the data, some positive and negative Z score values are derived. All Z scores under individual variable columns are summed up, resulting some composite index (CI) values (Table 8.3). From these composite index values three categories of agricultural development regions have been delineated. Index below 0 has been assigned the ‘low’, between 0.00 – 3.00 ‘medium’ and above 3.00 ‘high’ (table 8.4 and Fig 8.1)
Table 8.1: Some Indicators of Agricultural Development in Darrang District, 2010-11

<table>
<thead>
<tr>
<th>Development Blocks</th>
<th>Physiological density (persons/sq. km. of cultivated land)</th>
<th>Index of Intensity of cropping</th>
<th>Percentage of area under irrigation to total cropped area</th>
<th>Percentage of area under fertilizer to total cropped area</th>
<th>Percentage of area under HYV Rice to total Rice area</th>
<th>Crop Diversification Index</th>
<th>Agricultural productivity index (Kendall method)</th>
<th>Percentage of area under commercial crops</th>
<th>Productivity of rice quintal/hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sipajhar</td>
<td>531.42</td>
<td>143.07</td>
<td>30.13</td>
<td>47.90</td>
<td>19.28</td>
<td>19.48</td>
<td>3</td>
<td>9.28</td>
<td>13965.21</td>
</tr>
<tr>
<td>Pub Mangaldai</td>
<td>616.61</td>
<td>181.48</td>
<td>70.44</td>
<td>83.91</td>
<td>12.93</td>
<td>14.12</td>
<td>4.1</td>
<td>12.64</td>
<td>9966.96</td>
</tr>
<tr>
<td>Pachim Mangaldai</td>
<td>410.48</td>
<td>132.44</td>
<td>70.22</td>
<td>50.08</td>
<td>10.01</td>
<td>18.37</td>
<td>4.89</td>
<td>5.25</td>
<td>7807.89</td>
</tr>
<tr>
<td>Dalgaon – Sialmari</td>
<td>365.63</td>
<td>277.06</td>
<td>90.07</td>
<td>95.93</td>
<td>16.31</td>
<td>13.45</td>
<td>2.11</td>
<td>43.70</td>
<td>11974.72</td>
</tr>
<tr>
<td>Bechimari</td>
<td>339.55</td>
<td>225</td>
<td>86.99</td>
<td>93.44</td>
<td>17.75</td>
<td>13.5</td>
<td>2.7</td>
<td>37.70</td>
<td>12341.52</td>
</tr>
<tr>
<td>Kalaigaon</td>
<td>486.66</td>
<td>163.36</td>
<td>64.27</td>
<td>72.21</td>
<td>21.48</td>
<td>15.76</td>
<td>3.25</td>
<td>13.32</td>
<td>16380.18</td>
</tr>
<tr>
<td>Haarabari</td>
<td>1204.14</td>
<td>157.88</td>
<td>13.63</td>
<td>16.49</td>
<td>2.23</td>
<td>15.86</td>
<td>6.6</td>
<td>4.11</td>
<td>1481.46</td>
</tr>
</tbody>
</table>

Source: Calculated on the basis of the Primary Data Collected from the Field-2010-11 and Also Block Annual Progress Report, 2007-08

High Agricultural Development Region

The Dalgaon – Sialmari and Bechimari development blocks form the areas of high agricultural development in the district. These two development blocks are located in the built-up region of the district. Most of the people of these two development blocks are Muslims of immigrant origin. The net sown area accounts for 48.81 and 62.87 percents of the total area of Dalgaon – Sialmari and Bechimari development blocks respectively in 1991. It is increased to 92.45 and 99.35 percents in 2010-11 in these two development blocks respectively (table 4.2). The degree of double and multiple cropping in the net sown area is also higher, the indices of cropping intensity being 277.06 and 225 for Dalgaon – Sialmari and Bechimari development blocks respectively.
Table 8.2: Data Matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>Blocks</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
<th>X7</th>
<th>X8</th>
<th>X9</th>
<th>X10</th>
<th>X11</th>
<th>X12</th>
<th>X13</th>
<th>X14</th>
<th>X15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sipajhar</td>
<td>143.07</td>
<td>19.28</td>
<td>3.71</td>
<td>19.48</td>
<td>30.13</td>
<td>3</td>
<td>47.90</td>
<td>21.53</td>
<td>9.26</td>
<td>1.96</td>
<td>5.88</td>
<td>69.61</td>
<td>18.95</td>
<td>3.59</td>
<td>1.56</td>
<td></td>
</tr>
<tr>
<td>Pub Mangaldai</td>
<td>81.48</td>
<td>12.93</td>
<td>3.11</td>
<td>14.12</td>
<td>70.44</td>
<td>4.1</td>
<td>83.91</td>
<td>74.15</td>
<td>12.64</td>
<td>2.96</td>
<td>7.55</td>
<td>72.51</td>
<td>35.04</td>
<td>5.12</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>Pachim Mangaldai</td>
<td>132.44</td>
<td>10.01</td>
<td>3.61</td>
<td>18.37</td>
<td>70.22</td>
<td>4.89</td>
<td>50.08</td>
<td>31.49</td>
<td>5.25</td>
<td>1.90</td>
<td>6.67</td>
<td>75.24</td>
<td>6.98</td>
<td>4.13</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>Dalgaon – Sialmari</td>
<td>277.06</td>
<td>16.31</td>
<td>4.55</td>
<td>13.45</td>
<td>90.07</td>
<td>2.11</td>
<td>95.93</td>
<td>77.55</td>
<td>43.70</td>
<td>2.75</td>
<td>5.50</td>
<td>67.44</td>
<td>30.87</td>
<td>12.05</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Bechimari</td>
<td>225</td>
<td>17.75</td>
<td>6.48</td>
<td>13.5</td>
<td>86.99</td>
<td>2.7</td>
<td>93.44</td>
<td>60.55</td>
<td>37.70</td>
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<td>20.74</td>
<td>11.19</td>
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<tr>
<td>Kalaigaon</td>
<td>163.36</td>
<td>21.48</td>
<td>4.99</td>
<td>15.76</td>
<td>64.27</td>
<td>3.25</td>
<td>72.21</td>
<td>47.05</td>
<td>13.32</td>
<td>1.34</td>
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<td>82.30</td>
<td>14.74</td>
<td>4.56</td>
<td>1.06</td>
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</tr>
<tr>
<td>Khairabari</td>
<td>157.88</td>
<td>2.23</td>
<td>4.98</td>
<td>15.86</td>
<td>13.63</td>
<td>6.6</td>
<td>16.49</td>
<td>7.04</td>
<td>4.11</td>
<td>1.85</td>
<td>1.85</td>
<td>75.92</td>
<td>3.70</td>
<td>1.85</td>
<td>1.06</td>
<td></td>
</tr>
</tbody>
</table>

Source: Calculated on the basis of the Primary Data Collected from the Field-2010-11

Table 8.3: Z – Scores (Level of agricultural development in Darrang district, 2010-11)

<table>
<thead>
<tr>
<th>Blocks</th>
<th>Zc1</th>
<th>Zc2</th>
<th>Zc3</th>
<th>Zc4</th>
<th>Zc5</th>
<th>Zc6</th>
<th>Zc7</th>
<th>Zc8</th>
<th>Zc9</th>
<th>Zc10</th>
<th>Zc11</th>
<th>Zc12</th>
<th>Zc13</th>
<th>Zc14</th>
<th>Zc15</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sipajhar</td>
<td>-0.83</td>
<td>0.82</td>
<td>-0.74</td>
<td>1.67</td>
<td>-1.16</td>
<td>-0.57</td>
<td>-0.66</td>
<td>-0.97</td>
<td>-0.59</td>
<td>-0.42</td>
<td>0.48</td>
<td>-1.00</td>
<td>0.02</td>
<td>-0.68</td>
<td>2.13</td>
<td>-2.5</td>
</tr>
<tr>
<td>Pub Mangaldai</td>
<td>-0.03</td>
<td>-0.22</td>
<td>-1.31</td>
<td>-0.76</td>
<td>0.36</td>
<td>0.21</td>
<td>0.68</td>
<td>1.15</td>
<td>-0.36</td>
<td>1.44</td>
<td>1.39</td>
<td>-0.48</td>
<td>1.53</td>
<td>-0.26</td>
<td>-0.52</td>
<td>2.82</td>
</tr>
<tr>
<td>Pachim Mangaldai</td>
<td>-1.06</td>
<td>-0.70</td>
<td>-0.84</td>
<td>1.17</td>
<td>0.35</td>
<td>0.76</td>
<td>-0.58</td>
<td>-0.57</td>
<td>-0.86</td>
<td>-0.54</td>
<td>0.91</td>
<td>5.38</td>
<td>-1.09</td>
<td>-0.53</td>
<td>-0.70</td>
<td>1.1</td>
</tr>
<tr>
<td>Dalgaon – Sialmari</td>
<td>1.98</td>
<td>0.33</td>
<td>0.06</td>
<td>1.06</td>
<td>1.10</td>
<td>-1.19</td>
<td>1.13</td>
<td>1.28</td>
<td>1.74</td>
<td>1.04</td>
<td>0.27</td>
<td>-1.39</td>
<td>1.14</td>
<td>1.64</td>
<td>-0.34</td>
<td>7.73</td>
</tr>
<tr>
<td>Bechimari</td>
<td>0.88</td>
<td>0.57</td>
<td>1.89</td>
<td>-104</td>
<td>0.99</td>
<td>-0.78</td>
<td>1.03</td>
<td>0.60</td>
<td>1.33</td>
<td>0.69</td>
<td>-0.82</td>
<td>1.48</td>
<td>0.19</td>
<td>1.40</td>
<td>-1.18</td>
<td>7.23</td>
</tr>
<tr>
<td>Kalaigaon</td>
<td>-0.41</td>
<td>1.18</td>
<td>0.47</td>
<td>0.01</td>
<td>0.13</td>
<td>-0.39</td>
<td>0.24</td>
<td>0.06</td>
<td>-0.32</td>
<td>-1.58</td>
<td>-0.53</td>
<td>1.27</td>
<td>-0.37</td>
<td>-0.41</td>
<td>0.31</td>
<td>-0.36</td>
</tr>
<tr>
<td>Khairabari</td>
<td>-0.52</td>
<td>-1.98</td>
<td>0.46</td>
<td>0.03</td>
<td>-1.78</td>
<td>1.96</td>
<td>-1.83</td>
<td>-1.55</td>
<td>-0.94</td>
<td>-0.63</td>
<td>-1.72</td>
<td>0.13</td>
<td>-1.41</td>
<td>-1.16</td>
<td>0.31</td>
<td>-10.63</td>
</tr>
</tbody>
</table>

Source: Prepared on the basis of the table 8.2

Table 8.4: Level of Agricultural Development (Z score Method)

<table>
<thead>
<tr>
<th>Level of Development</th>
<th>Index Value</th>
<th>Name of the Development Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Below 0.00</td>
<td>Sipajhar, Kalaigaon and Khairabari</td>
</tr>
<tr>
<td>Medium</td>
<td>0.00 – 3.00</td>
<td>Pub-Mangaldai, Pachim-Mangaldai</td>
</tr>
<tr>
<td>High</td>
<td>Above 3.00</td>
<td>Dalgaon – Sialmari, Bechimari</td>
</tr>
</tbody>
</table>

Source: Prepared on the basis of the table 8.3

The total irrigated area constitutes 90.07 percent and 86.99 percent of the total cropped area of the Dalgaon – Sialmari and Bechimari development blocks respectively. The Muslim farmers of immigrant origin use different types of irrigation
facilities such as shallow tube well, power pump etc. They cultivate summer rice by using these irrigation facilities and so the productivity level of summer rice is high in Dalgaon – Sialmari development block. This summer rice is cultivated in all parts of this development block. Vegetables both rabi and kharif, pulses, rape & mustard, jute, potato etc. are cultivated in these two development blocks. Wheat is also cultivated in all parts of these development blocks and the productivity of this crop is higher than that of any other development blocks of the district. The yield index of vegetables, jute and potato in these two development blocks is also highest. The production of vegetables, jute and potato is 9120.6 quintal, 982.56 quintal and 1686.15 quintal per hectare in Dalgaon – Sialmari development block respectively. In Bechimari development block, the production of vegetables, jute and potato is 9900.6 quintal, 316.8 quintal and 965.7 quintal per hectare respectively. The production of vegetables is the highest in these two development blocks due to the soil condition and attitude of Muslim farmers of immigrant origin. The Muslim farmers of immigrant origin are traditionally most laborious and skillful. They use HYV seeds, fertilizers, pesticides and insecticides and other modern agricultural inputs in their agricultural lands to increase the production of both rabi and kharif crops. They are always keen to keep pace with the seasonal rhythm of the cultivation of the crops. The markets are always captured by their produces much earlier than the actual harvesting season. Vegetables particularly from the Dalgaon–Sialmari development block are brought to ‘Balugaon’ market and from the Bechimari development block are brought to ‘Bechimari’ market, the two market places of this locality for sending them to other places of Assam by trucks and other vehicles. Winter rice and autumn rice are also cultivated in these two
development blocks. The productivity of autumn rice is higher than that of any other development blocks of the district. The overall productivity level of agriculture in the Dalgaon – Sialmari and Bechimari development blocks is found to be the highest among all the development blocks of the district.

The area of fertilizer to the total cropped area of the Dalgaon – Sialmari and Bechimari development blocks is found to be the highest among all the development blocks of the district (95.93 percent and 93.44 percent respectively). The area of HYV rice in the Bechimari development block is the second highest (17.75 percent) among all the development blocks of the district. In Dalgaon – Sialmari development block, the area under HYV rice is 16.31 percent, which is the next to Bechimari development block.

The use of pesticides and insecticides is the highest in Dalgaon – Sialmari developments block and second highest in Bechimari development block among all the development blocks of the district (77.55 percent and 60.55 percent to the total cropped area respectively). The use of modern agricultural implements is also the highest in Dalgaon – Sialmari and Bechimari development blocks among all the development blocks of the district. The total members of implements are 732 and 635 in Dalgaon – Sialmari and Bechimari development blocks respectively. The use of power tiller, tractor, shallow tube well, spray machine, iron plough and others are the highest in these two development blocks than that of the other development blocks of the district.

All these factors and inputs have helped the Dalgaon – Sialmari and Bechimari development blocks to achieve a high level of agricultural development in the district.
Medium Agricultural Development Region

As many as two development blocks of the district constitute these areas of medium agricultural development. These development blocks are Pub-Mangaldai and Pachim-Mangaldai development blocks. These development blocks are located in the built-up region of the district. Different social groups are found in these development blocks. The net sown area of Pub-Mangaldai and Pachim-Mangaldai development blocks are 86.56 percent and 81.28 percent of the total geographical area in 1991 respectively. It is increased to 92.55 percent and 91.28 percent in 2010-11 respectively in these two development blocks. The intensity of cropping is medium in Pachim-Mangaldai and Pub-Mangaldai development block which ranges between 132.44 and 181.48. The total irrigated area constitutes 70.44 percent and 70.22 percent of the total cropped area of Pub-Mangaldai and Pachim-Mangaldai development blocks respectively. The area of fertilizer to the total cropped area of the Pub-Mangaldai and Pachim-Mangaldai development blocks is found to be medium (83.91 percent and 50.08 percent respectively). The area of HYV rice is 12.93 percent and 10.01 percent of these two development blocks which is medium among all the development blocks of the district. The area under commercial crops to the total cropped area is 12.64 percent and 5.25 percent in the Pub-Mangaldai and Pachim-Mangaldai development blocks respectively.

Most of the people inhabit in these two development blocks are of indigenous group. The char areas such as Dhariakhaiti and Banglaputta Chapari of these two development blocks are inhabited by the Muslims of immigrant origin. In these Char areas, the winter rice cannot be cultivated by the farmers belonging to Muslims of Immigrant origin on account of flood. But they cultivate huge quantity of the summer rice by the help of irrigation facilities and the use of fertilizers. The farmers of ST
village (Galaidingi) of Pub-Mangaldai block cultivate sufficient amount of summer rice by using the shallow tube well irrigation facilities. That is the reason why the production of summer rice is higher in this block in comparison to the other blocks of the district. This block ranks second in the production of summer rice with 4333.56 quintal/hectare. Similarly the Muslims of immigrant origin belonging to the char areas of Pachim Mangaldai block produce high amount of summer rice. There are sufficient grazing reserves and government vacant lands in these char areas of the Brahmaputra which are occupied by the Muslim of immigrant origin. In these char areas the Muslim farmers of immigrant origin cultivate different types of vegetables such as cabbages, cauliflowers, brinjal, chilli, ridge gourd, sponge gourd, cucumber, bitter gourd, bottle gourd, trichosenthus dioica, beans, lentil, sesamum, ladies finger etc by using bio and chemical fertilizers and irrigation facilities. Besides, they have been practising inter culture of various types of vegetables. As a result, the yield index of vegetables is high in Pub-Mangaldai development block having 1583.4 quintal/hectare and 384 quintal/hectare in Pachim-Mangaldai development block. On the other hand maize is cultivated mostly in the char areas of these two development blocks by the Muslim farmers of immigrant origin. The alluvial deposit which occurs in the char areas on account of the frequent flood, is suitable for maize cultivation. The production of maize is 255.9 quintal/hectare and 226.2 quintal/hectare in Pub-Mangaldai and Pachim Mangaldai development blocks respectively. The yield per hectare of pulses in Pub-Mangaldai development block is 134.1 quintal/hectare and 149.1 quintal/hectare in Pachim-Mangaldai development block. In the char areas of these two development blocks, the farmers of immigrant origin practise beans, blackgram, lentil with chilli, radish and brinjal. It may be said that the indigenous Hindu and Muslim farmers cultivate potato, vegetables and rape & mustard after harvesting the winter rice on the
The same plot of land in Pub-Mangaldai and Pachim-Mangaldai development blocks. The Scheduled Tribes cultivate mainly winter rice, summer rice and vegetables in these development blocks.

The use of modern agricultural implements such as iron plough, tractor, power tiller, shallow tube well, spray machine is the second highest among all these development blocks of the district. The total numbers of agricultural implements are 598 and 333 in Pub-Mangaldai and Pachim-Mangaldai development blocks respectively. As a result, the crop produced per head of agricultural worker is high in these development blocks. So, these two development blocks are included in the area of medium agricultural development. In fact, the use of irrigation, fertilizer, pesticides and insecticides and HYV seeds are higher in the areas of Pub-Mangaldai and Pachim-Mangaldai development blocks where Muslim farmers of immigrant origin are more, especially in the char areas. The arduous Mulsim farmers of immigrant origin produce a variety of crops by applying these inputs along with other modern technologies. On the other hand, the soil of these development blocks is fertile for growing winter rice and summer rice. All these help these two development blocks to increase the intensity of cropping to a certain degree and to achieve a medium level of agricultural development.

**Low Agricultural Development Region**

Three regions are identified as the areas of low agricultural development in the district, such as (i) the region comprising the Sipajhar development block located in the western part of the district, (ii) the region comprising the Kalaigaon development block located in the northern part of the district and (iii) the region comprising the Khairabari development block located in the north-western corner of the district.

The percentage of net sown area of Sipajhar, Kalaigaon and Khairabari development blocks are 82.97, 90.72 and 70.96 of the total geographical area in 2010-11.
respectively. The intensity of cropping of Sipajhar development block is low, which is 143.07 percent. In Khairabari and Kalaigaon development blocks, the intensity of cropping is medium, which ranges between 157.88 and 163.36. The productivities of crops are moderate to low.

Although different social groups are found to inhabit in these development blocks, the indigenous Hindu, Muslim and Scheduled Tribes people are found mostly. Khairabari development block is mostly inhabited by indigenous Hindu people.

The total irrigated area in Sipajhar and Khairabari development blocks is low, which is 30.13 percent in Sipajhar and 13.63 percent in Khairabari development blocks of the total cropped area. In Kalaigaon development block, the total irrigated area is 64.27 percent of the total cropped area. Only 20 to 25 percent of the working forces of each of these development blocks are engaged in tertiary occupation. In Kalaigaon development block, owing to the presence of the Galandi tea gardens, 15 percent of the working forces are engaged in secondary occupation. The yields per hectare of winter rice are 10565.55 quintal, 11718 quintal and 1296 quintal respectively in Sipajhar, Kalaigaon and Khairabari development blocks. The yields per hectare of summer rice are 2631.42, 4258.98 and 34.98 respectively in these development blocks. Yield per hectare of other crops are also moderate in Sipajhar and the Kalaigaon development blocks, but low in Khairabari development block. In the char areas of Sipajhar development block and in the areas inhabited by Muslims of immigrant origin, different types of vegetables, maize, pulses and jute are grown. The farmers of indigenous Hindu of these three development block, cultivate rape & mustard after harvesting the winter rice on the same plot of land. Vegetables and potato are also cultivated by the indigenous Hindu farmers.
The use of fertilizer, pesticides and insecticides and number of modern agricultural implements are also low to moderate in these development blocks. But the area of HYV rice is the highest in Kalaigaon development block (21.48 percent) among all the development blocks of the district. But in Khairabari development block, the area under HYV rice is only 2.23 percent of the total rice area of the block. The area under fertilizer is 47.90 percent, 72.21 percent and 16.49 percent of the total cropped area in Sipajhar, Kalaigaon and Khairabari development block respectively. Agricultural development of a region mainly depends on the cultivation of commercial crops such as vegetables, jute and potato. But the area under commercial crops is only 9.26 percent and 4.11 percent to the total cropped area in Sipajhar and Khairabari development blocks respectively. In Kalaigaon development block, the area under commercial crops is moderate, which is 13.32 percent to the total cropped area of the block. So, such conditions are not conducive for development of agriculture.

The presence of the braided river Brahmaputra, the Nanai and the Kulsi which cover about 50 percent of these Sipajhar and Kalaigaon development block’s total area, due to the frequent changes of the courses and the erosion activities on the banks, large number of cultivable areas are eaten up every year. Moreover, untimely occurrence of floods damage standing crops every year. Therefore, it is difficult to apply modern inputs and technologies for the floods. On the other hand, the different social groups of people are reluctant to use inputs in agriculture. Only the Muslim farmers of immigrant origin use modern agricultural implements and inputs to increase the productivity of different crops. Under circumstances, these development blocks are included in the area of low agricultural development.

From the foregoing discussion, it is found that the agricultural development of the district depends mainly on the physiological density and the social groups of
farmers. There is a variation of social groups of farmers with the variation of ecological settings. As a result, the level of agricultural development varies from development blocks to blocks. The Muslims of immigrant origin farmer inhabits in both the built-up and the Char regions of the district. It is found that the high level of agricultural development is found in the Muslims of immigrant origin inhabited development blocks like Dalgaon – Sialmari and Bechimari of the built-up region. But the level of agricultural development remains low in the Sipajhar, Pub-Mangaldai and Pachim Mangaldai development blocks, although these blocks are inhabited by Muslim farmers of immigrant origin. It is because of the fact that these development blocks lie in the char regions where cultivation is not possible in all the months and the application of modern technology is also not feasible in summer season due to flood.

In the development blocks of the built-up region where the Muslims of immigrant origin people live with the indigenous Hindu, Muslim and Scheduled Tribes groups, the level of agricultural development is medium, but the development block having sufficient char areas such as Sipajhar, the level of agricultural development is low, although the Muslim farmers of immigrant origin are found to inhabit side by side the indigenous farmers.
It may also be said that development and modernization of agriculture maintain an adverse effect with physiological density. The development status of the individual development blocks are based on Z scores. On the basis of the observation the basic analysis is that, overall agricultural development as well as agricultural modernization needs lowering of physiological density under the existing land use and cropping pattern. That is higher physiological density maintains lower scope for crop modernization and agricultural development (Fig 8.2).

Reference


