CHAPTER V
Irrigation and Agricultural Land Use
CHAPTER V
IRRIGATION AND AGRICULTURAL LAND USE

A. General Land Use Characteristics

Among all natural resources, land is considered to be the most significant and basic resource, since it is limited. Land use and land cover patterns in a region are the prerequisites for planning and implementation of effective land use policies and schemes for sustainable regional development. Land cover is defined as the layer of soils and biomass, including natural vegetation, crops and human structures, which comprise the land surface. Whereas, land use refers to the purposes for which humans exploit the land cover. Land use/cover change is the effect of many interacting processes that are active over a wide range of scales in space and time. Three types of causes in land use changes occur at different rates and at different scales: (i) biophysical, (ii) economic and technological considerations, and (iii) institutional and political arrangements (Suthakar and Bui, 2008).

In India, increasing pressure of population and consequently more demand for food put a great pressure on land. This exerts a great pressure on forest lands, fallow and other vacant lands, therefore, change is evident in land use (Singh, 1989). The future scope of expansion of area in favour of agriculture seems to be very limited. Whatever area which can be brought under cultivation would be marginal and ecologically fragile, which unambiguously cannot compensate for land being removed from cultivation due to urbanization and land degradation. Therefore, future agricultural supplies and growth be targeted primarily from biological crop yields and intensification of land use instead of areal expansion (GOI, 2009).

Table 5.1 and Fig 5.1 show the land utilization in the state of U.P during the periods of 1995-2000, 2000-05 and 2005-10 and respective growth during 1995-2000 to 2000-05 and 2000-05 to 2005-10. Reporting area stands for which land use statistics are available. Availability of land utilization figures is based on land records, basically according to village papers. The total reporting area of the state was 25.49, 24.20 and 23.90 million ha., respectively during the respective periods. Agriculture will continue to remain as the dominant sector in the economy and to support large population of the state. Of the total reporting area, net sown area constituted 69.15, 69.14 and 68.42 per cent, registering growth rates of -0.01 and
-1.04 per cent in both periods, respectively. Area sown more than once was 48.18 per cent of the net sown area during 1995-2000. It showed an increase of 5.04 and 5.76 per cent and increased to 50.61 and 53.53 to make up the gross cropped area as 102.67, 104.13 and 105.04 per cent, respectively. Therefore, it is clear that, there is a possibility to bring more area under double-cropping.

### Table 5.1 Land utilization statistics in Uttar Pradesh

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting Area (ha.)</td>
<td>2,54,96,915</td>
<td>2,42,09,544</td>
<td>2,39,09,223</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-5.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1.24</td>
</tr>
<tr>
<td>Forest</td>
<td>7.15</td>
<td>6.97</td>
<td>6.98</td>
<td>-2.53</td>
</tr>
<tr>
<td>Barren land</td>
<td>2.70</td>
<td>2.37</td>
<td>2.06</td>
<td>-12.00</td>
</tr>
<tr>
<td>Land not Available for utilization</td>
<td>9.85</td>
<td>10.53</td>
<td>11.39</td>
<td>6.89</td>
</tr>
<tr>
<td>Cultivable waste</td>
<td>2.44</td>
<td>2.05</td>
<td>1.81</td>
<td>-15.96</td>
</tr>
<tr>
<td>Pasture</td>
<td>0.28</td>
<td>0.28</td>
<td>0.27</td>
<td>0.99</td>
</tr>
<tr>
<td>Miscellaneous trees</td>
<td>1.31</td>
<td>1.44</td>
<td>1.53</td>
<td>10.08</td>
</tr>
<tr>
<td>Current fallow</td>
<td>4.22</td>
<td>4.69</td>
<td>5.33</td>
<td>11.20</td>
</tr>
<tr>
<td>Other than current fallow</td>
<td>2.92</td>
<td>2.53</td>
<td>2.21</td>
<td>-13.30</td>
</tr>
<tr>
<td>Net sown area</td>
<td>69.15</td>
<td>69.14</td>
<td>68.42</td>
<td>-0.01</td>
</tr>
<tr>
<td>Area sown more than once</td>
<td>48.18</td>
<td>50.61</td>
<td>53.53</td>
<td>5.64</td>
</tr>
<tr>
<td>Gross cropped area</td>
<td>102.67</td>
<td>104.13</td>
<td>105.04</td>
<td>1.43</td>
</tr>
<tr>
<td>Land cultivated in kharif season</td>
<td>47.51</td>
<td>48.20</td>
<td>48.83</td>
<td>1.47</td>
</tr>
<tr>
<td>Land cultivated in rabi season</td>
<td>51.71</td>
<td>52.46</td>
<td>52.56</td>
<td>1.46</td>
</tr>
<tr>
<td>Land cultivated in zaid season</td>
<td>3.93</td>
<td>3.44</td>
<td>3.59</td>
<td>-20.92</td>
</tr>
</tbody>
</table>

**Note:** Data is in percentage of reporting area of the state.

1) 1995-2000 to 2000-05
2) 2000-05 to 2005-10

**Source:** Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

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**Fig. 5.1**

UTTAR PRADESH Land Use Pattern
Forested land covered 7.15, 6.97 and 6.98 per cent area in the respective years with a growth rate of -2.53 and 0.22 per cent, respectively. Current fallow lands recorded an increase whereas, other than current fallow lands showed a decrease in area during both the periods. Area under barren lands and culturable waste lands recorded declining trends of -12 and -13.22, and -15.96 and -11.58 per cent in the respective periods. Area not available for utilization includes all lands occupied by buildings, roads, railways or water, e.g. rivers and canals, and land put to uses other than agriculture, recorded positive growth rates of 6.89 and 8.23 per cent during these periods making a share of 9.85, 10.53 and 11.39 per cent to the reporting area of the state. This has happened at the expanse of area under barren lands, culturable waste lands, pastures and other fallow lands, which showed a marked decrease during these periods. Areas under *zaids* crop season also showed a decrease of -20.02 per cent during 1995-2000 to 2000-05, but in later period it recorded a significant increase of 14.43 per cent (Table 5.1).

### a. Gross cropped area

Gross cropped area refers to the total area sown once and/or sown more than once in a particular year, i.e. the area counted as many times as there are sowings in a particular year. This is considered to be an important indicator to the degree of intensity to which land is used for agricultural purposes. Percentage share of gross cropped area to the total reporting area of the state is shown in Table 5.2. There were 19 districts namely, Rampur, Moradabad, Aligarh, Bulandshahr, Shahjahanpur, Budaun, Bareilly, Hathras, Baghpat, Mainpuri, Deoria, Siddharthnagar, Maharajganj, Etah, Barabanki, Azamgarh, Ghazipur, J.P. Nagar and Firozabad which recorded above 120 per cent of gross cropped area to the reporting area of the state during 2005-10. In this category, there were 14 and 15 districts during 1995-2000 and 2000-05, respectively.

Within the category of 100 to 120 per cent gross cropped area, there were 26, 29 and 25 districts, respectively. Between the range of 80 and 100 per cent gross cropped area, the number of districts were in order of 24, 21 and 22, respectively in the corresponding periods of study. The districts namely, Mirzapur and Lalitpur fall in the category of 60-80 per cent during 1995-2000, G.B. Nagar was added in this category during 2000-05 and in 2005-10, only one district of Lalitpur occupied place in this category. Below 60 per cent of gross cropped area was recorded by Chitrakoot.
and Sonbhadra districts during both the previous periods, and Mirzapur district was added to this category during 2005-10.

### Table 5.2 Gross cropped area to the reporting area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>1995-2000</th>
<th>2000-05</th>
<th>2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Name of district</td>
<td>No.</td>
</tr>
<tr>
<td><strong>Very high</strong> (Above 120)</td>
<td>14</td>
<td>Rampur, Bulandshahr, Moradabad, Alligarh, Baghat, Bareilly, Shahjahanpur, Hathras, Budana, Mal, J.P.Nagar, Deoria, Mahanagarjpur and Ghazipur</td>
<td>15</td>
</tr>
<tr>
<td><strong>Medium</strong> (80-100)</td>
<td>24</td>
<td>S. R. Nagar, Gonda, Unnao, Kanpur Dehat, Fathipur, Kanpur Nagar, Hijjor, Pratapgarh, Rae Bareli, Bahraich, Chandauli, Kheri, Allahabad, Faizabad, Bullarmpur, Bara, Lucknow, Jalal, Kaushani, Hamirpur, G.B. Nagar, Etawah, Mahoba and Hamirpur</td>
<td>21</td>
</tr>
<tr>
<td><strong>Low</strong> (60-80)</td>
<td>2</td>
<td>Mirzapur and Lalitpur</td>
<td>3</td>
</tr>
<tr>
<td><strong>Very low</strong> (Below 60)</td>
<td>2</td>
<td>Chitrakoot and Sonbhadra</td>
<td>2</td>
</tr>
</tbody>
</table>

**Note:** Data for Amjpur and Ambilik Nagar districts was not available during the period of 1995-2000.

**Source:** Bulletin of agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

During the period of 1995-2000 to 2000-05, high growth in gross cropped area (above 10 per cent) was recorded by the districts namely, Etawah (18.40), Gonda (15.82), Faizabad (13.34), Bahraich (12.50), Bandha (12.42), Ballarmpur (11.36) and Lalitpur (10.31). During 2000-05 to 2005-10, the districts of G.B.Nagar, Mainpur and Lalitpur were included in this category. Medium growth of 0 to 10 per
cent was seen in 41 and 36 districts, respectively in the corresponding periods. Low growth was occupied in 20 districts during the previous period, whereas in the later period, there were 29 districts which fall in the category of low growth of -10 to 0 per cent, and the districts of Mirzapur (-10.72) and Sonbhadra (-32) were characterized with very low growth (below -10 per cent) during the later period (Table 5.3).

Table 5.3 Growth in gross cropped area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (Per cent)</th>
<th>Number of districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 10</td>
<td>7</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 10</td>
<td>41</td>
</tr>
<tr>
<td>Low</td>
<td>-10 to 0</td>
<td>20</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -10</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

b. Net sown area

Net sown area refers to the total area sown with crops and orchards in a single year. Area sown more than once in the same year is counted only once. This area has a special significance in agriculture because the agricultural production largely depends upon this type of land use. During 1995-2000, the districts namely, Moradabad, Baghpat, Rampur, Hathras, Mathura, Bareilly, Siddharthnagar, J.P.Nagar and Deoria recorded above 80 per cent of net sown area in the state (Table 5.4). During 2000-05, the number of districts remained 9 to be incorporated in this category by adding 2 districts of Aligarh and Bulandshahr in place of the districts of Deoria and J.P.Nagar. During the period of 2005-10, there were 9 districts namely, Moradabad, Hathras, Rampur, Bulandshahr, Mathura, Aligarh, Baghpat, Bareilly and Budaun to include within this category. Within the category of 70 to 80 per cent of net sown area, there were 30, 32 and 28 districts, respectively during the period of 1995-2000, 2000-05 and 2005-10. In the category of 60 to 70 per cent net sown area, there were 23, 23 and 25 districts to be incorporated in the respective periods. Whereas, 50 to 60 per cent of area was recorded in 2, 4 and 6 districts, respectively. Below 50 per cent of net sown area was seen in the districts of Chitrakoot, Lalitpur, Mirzapur and Sonbhadra during 1995-2000. Two districts namely, Mirzapur and Sonbhadra again formed part of this category during later periods, respectively.

It is seen from Table 5.5 that, high growth of above 5 per cent was secured by
Table 5.4 Net sown area to the reporting area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>1995-2000</th>
<th>2000-05</th>
<th>2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Name of district</td>
<td>No.</td>
<td>Name of district</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
<td>------</td>
<td>------------------</td>
</tr>
<tr>
<td>Very high (Above 80)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Moradabad, Baghpat, Rampur, Hathras, Mathura, Bareilly, Siddharthnagar, J.P.Nagar and Deoria</td>
<td>9</td>
<td>Moradabad, Hathras, Rampur, Baghpat, Mathura, Aligarh, Bulandshahr, Bareilly and Siddharthnagar</td>
</tr>
<tr>
<td>High (70-80)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium (60-70)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (50-60)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Lucknow, Chandauli</td>
<td>4</td>
<td>Lucknow, Chandauli, Chitrakoot and Lalitpur</td>
</tr>
<tr>
<td>Very low (Below 50)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Chitrakoot, Mirzapur and Sonbhadra</td>
<td>2</td>
<td>Mirzapur and Sonbhadra</td>
</tr>
</tbody>
</table>

Note: Data for Araria and Ambekar Nagar districts was not available during the period of 1995-2000. Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

the districts of Gonda and Banda during 1995-2000 to 2000-05, and during the period of 2000-05 to 2005-10, Lalitpur district remained a high growth. Medium growth was recorded in 34 and 30 districts, respectively during the corresponding periods, whereas, low growth of -5 to 0 per cent was seen in 27 and 30 districts, respectively. Very low growth below -5 per cent was recorded by the districts of Allahabad, Meerut, Etawah, Faizabad and S.K.Nagar during the previous period, and in Hamirpur, Ghaziapur, Mahoba, Mirzapur, Jhansi, G.B.Nagar, Allahabad, Varanasi and Sonbhadra during the later period.
Table 5.5 Growth in net sown area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (Per cent)</th>
<th>Number of districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 5</td>
<td>2</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 5</td>
<td>34</td>
</tr>
<tr>
<td>Low</td>
<td>-5 to 0</td>
<td>27</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -10</td>
<td>5</td>
</tr>
</tbody>
</table>

*Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.*

c. Area sown more than once

Area sown more than once refers to the area on which crops are cultivated more than once during an agricultural year. This category of land use is obtained by deducting net sown area from that of the gross cropped area. Area sown more than once within the category of above 70 per cent was represented by 3 districts namely, Rampur, Maharajganj and Bulandshahr during 1995-2000. The number of districts increased to 5 and 12 in subsequent periods. During 2005-10, the districts namely, Rampur, Mainpuri, Barabanki, Chandauli, Maharajganj, Moradabad, Aligarh, Shahjahanpur, Bulandshahr, S.K.Nagar, Azamgarh and Pilibhit were included in this category. In the next category of 55 to 70 per cent area sown more than once, there were 21, 25 and 20 districts in the respective periods. In between 40 to 55 per cent of area was occupied by 31, 28 and 26 districts, respectively. Whereas, in the category of 25 to 40 per cent of area sown more than once, there were 6, 6 and 7 districts, respectively in the corresponding periods. Below 25 per cent of area sown more than once was occupied by the districts of Banda, Jhansi, G.B.Nagar, Mahoba, Chitrakoot, Jalaun and Hamirpur during 1995-2000. In the next periods, the districts of Mahoba and Jhansi were shifted from this category to higher categories (Table 5.6).

It is evident from Table 5.7 that during the period of 1995-2000 to 2000-05, high growth of above 20 per cent was seen in S.K.Nagar, Balrampur, Jhansi, Hamirpur, Jalaun and Lalitpur. During the period of 2000-05 to 2005-10, 8 districts namely, G.B.Nagar, Jhansi, Mahoba, Jalaun, Varanasi, Mainpuri, Siddharthnagar and Lalitpur were included within this category. Medium growth was recorded in 40 and 37 districts of the state, respectively during these periods. There were 20 and 21 districts, respectively which showed low growth in area sown more than once. A very low growth was visible in districts namely, Farrukhabad and G.B.Nagar during previous period and Pratapgarh, Shrawasti, Chitrakoot and Sonbhadra had very low growth during the later period.
### Table 5.6 Area sown more than once to net sown area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>1995-2000</th>
<th>2000-05</th>
<th>2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Name of district</td>
<td>No.</td>
<td>Name of district</td>
</tr>
<tr>
<td>Very high (Above 70)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rampur, Maharajganj and Bulandshahr</td>
<td>5</td>
<td>Rampur, Maharajganj, Barabanki, Chandauli and Moradabad</td>
</tr>
<tr>
<td>High (55-70)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium (40-55)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Sultanpur, Farrukhabad, Jaunpur, Deoria, J.P.Nagar, Lucknow, Kanpur, Naga, Ghazipur, Varanasi, Firozabad, Pratapgarh, Mozaffarnagar, Hardoi, Unnao, Gonda, Gorakhpur, Balasore, Rae Bareli, Basti, Kheri, Kushinagar, Mirzapur, Shravasti, Mathura, S.R. Nagar, Sonhada, Allahabad, Fatehpur, S.K.Nagar, Siddharthnagar and Agra</td>
<td>28</td>
<td>J.P.Nagar, Lucknow, Meerut, Firozabad, Kushinagar, Balasore, Hardoi, Shravasti, Sultanpur, Bijnor, Mathura, Gorakhpur, Rae Bareli, Allahabad, Unnao, Pratapgarh, Mozaffarnagar, Kheri, Sitapur, Basti, Varanasi, S.R. Nagar, Mirzapur, Kanpur Nagar, Agra, Siddharthnagar, Farrukhabad and Sonhada</td>
</tr>
<tr>
<td>Low (25-40)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Kanpur Dehat, Sitapur, Bijnor, Lalitpur and Kaushambi</td>
<td>6</td>
<td>Kanpur Dehat, Fatehpur, Lalitpur, Kaushambi, Bijnor and Sonhda</td>
</tr>
<tr>
<td>Very low (Below 25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Banda, Jhansi, G.B.Nagar, Mahoba, Chitrakoot, Jalaun and Hamirpur</td>
<td>6</td>
<td>Banda, Jalaun, Mahoba, Hamirpur, G.B.Nagar and Chitrakoot</td>
</tr>
</tbody>
</table>

*Note: Data for Auraiya and Ambdelkar Nagar districts was not available during the period of 1995-2000.*

*Source: Bulletins of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.*

### Table 5.7 Growth in area sown more than once in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>Range (Per cent)</th>
<th>Number of districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 20</td>
<td>6</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 20</td>
<td>40</td>
</tr>
<tr>
<td>Low</td>
<td>-20 to 0</td>
<td>20</td>
</tr>
<tr>
<td>Very Low</td>
<td>Below -20</td>
<td>2</td>
</tr>
</tbody>
</table>

*Source: Bulletins of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.*
B. Changes in Cropping Pattern of Cereal, Pulse, Oilseed and Cash Crops

Cropping pattern has always been a dynamic phenomenon. It may be defined as the quality of crops grown usually on a plot of land during a particular agricultural year (Verma, 1993). It is a reflection of interplay of the complex physical, socioeconomic and technological factors. All these factors themselves keep on changing, except physical ones, which are comparatively static. Thus, under the influence of these factors, the cropping pattern also goes on changing, so much so that, sometimes, it is entirely replaced after a long span of time (Singh, 1992). In other words, cropping pattern in an area or a region keeps on changing in consonance with change in agricultural practices, government policies and other related factors. Changes in cropping pattern can be seen within the frame of factors like agro-climatic conditions, technological, infrastructural and institutional environment and profitability derived. New technologies, such as HYV seeds, can work with relative price levels to change cropping patterns. Moreover, the role of inputs, such as investment in irrigation infrastructure like the installation of tubewells, or the use of new seeds and fertilizers make it possible to raise yields. This highlights the importance of modern inputs in raising the value productivity of crops and changes in cropping patterns (Bajpai and Volavka, 2005).

In general, the geographic patterns of agricultural land-use are the outcome of concurrent interaction between the variable combinations pertaining to natural conditions and human interactions. Interestingly the human interactions are responsible mainly for dynamism in agricultural land-use and changing cropping patterns. Technological changes of mid-sixties caused significant shifts in land utilization in favour of crops like wheat and rice at the cost of area under coarse grains, pulses and oilseeds. In addition, efficient cropping pattern implies the profitable use of land, consequent upon the development of irrigation facilities and application of modern modes of farm technology (Chhaukar and Mittal, 2007). Consequently, this shift has been the combined effect of differential rates of technological change among crops, irrigation bias of new technology causing shifts of land from dry crops in favour of irrigated crops, and the associated policy of price support system as well as market intervention by the government of certain crops. Nevertheless, irrigation is one of the basic inputs on which the cropping pattern, cropping intensity and agricultural output depends. It makes agriculture relatively less dependent on rainfall and encourages farmers to switch on for double/multiple...
cropping.

There is skewness in land distribution system in the country. Some are big farmers and some are medium, small and marginal farmers. With the provision of irrigation facility, there is a probability that big and medium farmers may take a shift from subsistence households to surplus households because of increase in cropping intensity and hence production. The small and marginal farmers may take a shift from the deficit farm households to subsistence farm households. Thus, surplus production of food and non-foodgrains over and above the domestic consumption will come to market. Thus, irrigation has a potentiality to change cropping pattern (Verma, 1993).

Changes in cropping pattern are measured by establishing the proportion of total cropland occupied by individual crops in the state during three quinquennial periods. Because of variations in crop data from year to year to enumerate cropping pattern, the proportion of croplands devoted to each crop were averaged for three sets of years: 1995-96 to 1999-2000, 2000-01 to 2004-05 and 2005-06 to 2009-10. The districtwise cropping patterns as per cent of area cultivated to gross cropped area are presented in Appendices III, IV and V. There is a wide gap in percentage share of cropland of four groups of crops: cereals, pulses, oilseeds and cash crops. Fig. 5.2 further shows that, cereal crops cover a major proportion of the gross cropped area (about 68 per cent) indicating that cereals constitute a major share in cropland use in the state. Among all the cereal crops, wheat and rice are the dominant crops covering roughly around 60 per cent of the total cropped area in the state.

The main changes in relative importance of crops from 1995-2000 to 2000-05 are seen in the state, the decline of area under major pulses and oilseeds with a negative growth of -1.86 and -22.32 per cent, and an increase in area under cereals and cash crops to the tune of 2.40 and 7.07 per cent, respectively. During the later period from 2000-05 to 2005-10, area under cereals declined (-0.01 per cent) along with area under pulse crops (-9.98 per cent). Contrary to this, oilseeds and cash crops recorded an increase of 20.34 and 5.76 per cent, respectively.

The patterns of change (positive and negative order) in area within four categories of crops indicate that, the highest decline during previous period in cropland was observed in soyabean (-73.45), followed by moong, jowar, groundnut, mustard and rapeseed, barley, arhar, pfas, maize, gram and til to the tune of -37.98, -26.60, -22.62, -22.58, -21.67, -17.81, -14.94, -14.78, -10.91 and -3.60 per cent.
respectively. Rice, wheat and bajra among cereals, and pulse crops of urad and masoor showed a positive change in order of 5.07, 4.94 and 1.99, and 46.01 and 16.39 per cent, respectively. The increase in area was also observed in cash crops (sugarcane and potato) with 7.91 and 3.15 per cent, respectively. During 2000-05 to 2005-10, a positive change was observed in wheat and bajra crops among the cereals, with a change of 1.71 and 3.80 per cent, respectively, and oilseeds namely, mustard and rapeseed (5.26 per cent) and til (144.67 per cent) also recorded a positive change. Potatoes and sugarcane also showed a positive change of 17.84 and 3.28 per cent, respectively. Rest of the crops showed a negative change during this period (Fig. 5.3).

a. Cereal crops

During 1995-2000, there were six districts namely, Chandauli (87.72 per cent), Ambedkar Nagar (87.05), Siddharthanagar (86.71), Mau (86.25) Gorakhpur (85.54) and S. K. Nagar (85.31) occupied more than 85 per cent area tinder cereals to the gross cropped area. During the next period of 2000-05, the number of districts increased to 9 namely, Siddharthanagar (89.49), Gorakhpur (89.09), Mau (88.76), S.K.Nagar (88), Deoria (87.51), Azamgarh (87.05), Chandauli (86.95), and S.R.Nagar (85.99) and Maharajganj (85.34). During the period of 2005-10, three more districts were added namely, Ghazipur, Jaunpur and Pratapgarh to make up the category consting 12 districts (Table 5.8). In the next category of area in between 70 and 85 per cent, there were 28, 30 and 27 districts, respectively counted in the corresponding periods. In the category in which values of cropped area ranged in between 55 and 70 per cent under cereals decreased to 17 districts during 2005-10; and this decrease in number of districts continued from 24 and 19 during 1995-2000 and 2000-05, respectively. Whereas, in the range of 40-55 per cent and below 40 per cent area under cereals, the number of districts were 4, 3 and 6 in previous category, and number of districts 8, 9 and 8 in later in successive periods, respectively (Figs. 5.4, 5.5 and 5.6).

The proportion of area under cereals increased to 2.40 per cent during the period of 1995-2000 to 2000-05. During 2000-05 to 2005-10, it recorded a decline of -0.01 per cent. During previous period, the districts which recorded high growth of above 10 per cent in area under cereals were namely, Faizabad, Deoria, Varanasi and Aligarh with 33.15, 26.12, 23.02 and 10.04 per cent, respectively (Table 5.9). During
Fig. 5.2

UTTAR PRADESH
Cropping Pattern

Fig. 5.3

UTTAR PRADESH
Change in Cropping Pattern

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### Table 5.8 Area under cereal crops to gross cropped area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category</th>
<th>No.</th>
<th>Name of district</th>
<th>No.</th>
<th>Name of district</th>
<th>No.</th>
<th>Name of district</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>4</td>
<td>J.P. Nagar, Saharanpur, Ghaziabad, Lalitpur</td>
<td>3</td>
<td>J.P. Nagar, Saharanpur, Ghaziabad</td>
<td>6</td>
<td>Kheri, Chitrakoot, J.P. Nagar, Ghaziabad, Saharanpur, Jhansi</td>
</tr>
<tr>
<td>Very low</td>
<td>8</td>
<td>Bijnaor, Jalua, Hamirpur, Meera, Bijnor, Jhalpur</td>
<td>9</td>
<td>Jhalpur, Lalitpur, Bijnaor, Baghpur, Hamirpur, Meera, Bijnor, Jhalpur, Meera, Mahoba</td>
<td>8</td>
<td>Bijnaor, Lalitpur, Baghpur, Hamirpur, Jhalpur, Meera, Bijnor, Meera, Mahoba</td>
</tr>
</tbody>
</table>

Sources: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

### Table 5.9 Growth in area under cereal crops in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (Per cent)</th>
<th>Number of districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 10</td>
<td>4</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 10</td>
<td>39</td>
</tr>
<tr>
<td>Low</td>
<td>-10 to 0</td>
<td>25</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -10</td>
<td>2</td>
</tr>
</tbody>
</table>

Sources: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.
UTTAR PRADESH
Cropping Pattern
1995-2000

Fig. 5.4
UTTAR PRADESH
Cropping Pattern
2000-05

Note: Circles are proportional to gross cropped area of the districts.

Fig. 5.5
the next period, 2 districts namely, Etawah and Ghazipur were included in this category. In the next category of 0 to 10 per cent of growth, there were 39 and 34 districts, respectively, which were included in this category during both the periods of study. As much as 25 and 33 districts of the state, respectively recorded a low growth in between -10 and 0 per cent, whereas, in the next category of below -10 per cent, the districts namely, Lalitpur and Mahoba recorded a negative growth of -13.56 and -18.22 per cent, respectively during previous period and during later period, a single district of Mahoba falls in this category.

I. Wheat

Wheat constitutes an important staple crop in human food consumption. The major wheat producing states in India are U.P., Punjab and Haryana contributing nearly 80 per cent of the total wheat production in the country. With the adoption of wheat and rice in India since Green Revolution, production of cereals including production of wheat increased from a mere 8.6 million tonnes in 1960-61 to 73.53 million tonnes in 1999-2000. The country has witnessed a substantial change in past 4-5 decades, with an overall wheat production increased at a compounded annual growth rate of 4.22 per cent during 1960-2010. The share of wheat in the Indian foodgrains production has been around 35.5 per cent and covered alone about 22 per cent of the total area under foodgrains (The Economic Times, 2012).

The area under wheat cultivation has increased from 9.75 million ha. in 1950-5.1 to 27.4 million ha. in 1999-2000, showing a net increase of 181 per cent during the entire period. This gain has been made possible at the expense of coarser rabi crops (barley, gram etc.) and owing to increased irrigation facilities and profitability derived from wheat cultivation. Green revolution has been synonym to wheat revolution in India, enabling the country not only to attain self-sufficiency in foodgrains, but also to generate some surpluses to be kept in buffer-stocks and even for export.

U.P. contributes the highest share both in area and production of wheat in the country. Most of the wheat production comes from areas of the Ganga-Yamuna doab and of the Rohilkhand plains. Out of 100 wheat producing districts of the country, 43 belong to U.P. and 19 of them to western part of the state. In these districts, canal and tubewell irrigation, greater use of HYV seeds, fertilizers and new farm techniques have provided incentives to the farmers for the cultivation of wheat (Raja, 2012).
Appendices III, IV and V show proportion of the area to gross cropped area of individual crops grown in the state during the study periods. Wheat occupied 9.41 million ha. or about 36 per cent of the total cultivated area. An area 35.13, 36.87 and 37.50 per cent, respectively was devoted to wheat in the state during 1995-2000, 2000-05 and 2005-10. During 1995-2000, above 40 per cent of area was devoted to wheat cultivation in the districts namely, Gorakhpur, S.R. Nagar, Unnao, G.B. Nagar, Mathura, Mau, Ambedkar Nagar, Hardoi, Mainpuri, Azamgarh, Budaun, Pratapgarh, Shahjahanpur, Rae Bareli, S.K. Nagar, Jaunpur. The number of districts in this category increased to 25 and 26 during the later periods of 2000-05 and 2005-10, respectively. Between the ranges of 35-40 per cent, the numbers of districts were 19, 19 and 20 in the corresponding periods, respectively. During 1995-2000, the districts which had 30-35 per cent of area under wheat crop were 22, the number of districts decreased from 22 to 14 and 12, respectively in the later periods. Within the category of 25-30 per cent area under wheat, the numbers of districts were in order of 11, 8 and 10, respectively. Very small area under wheat (below 25 per cent) during the respective periods was seen in Hamirpur and Sonbhadra which are characterized as non-wheat growing districts of Bundelkhand during 1995-2000. During 2000-05, the districts namely, Bijnor and Mahoba were added in this category whereas, in 2005-10, only the districts of Lalitpur and Hamirpur belonged to this category.

A positive growth in wheat sown area during the previous periods from 1995-2000 to 2000-05 was recorded in 52 districts, in which high growth of above 10 per cent occurred in 14 districts namely, Faizabad, Varanasi, Deoria, Bahraich, Jalaun, Kanpur Dehat, Siddharthnagar, Rampur, Hardoi, Etah, Mathura, Aligarh, Hathras and G.B. Nagar. During later period of 2000-05 to 2005-10, only 5 districts namely, Etawah, Sonbhadra, Hamirpur, Ghazipur and Banda recorded high growth. Medium growth between 0 to 10 per cent was observed in 38 and 40 districts in respective periods. A negative and low growth of -10 to 0 per cent was seen in 15 and 24 districts, respectively. The districts having very low growth (below -10 per cent) were namely, Mahoba (-13.91), Lalitpur (-15.61) and Balrampur (-18.79) during previous period and during later period Mahoba was the only districts which was included in this category.

ii. Rice

Rice is also an important cereal food crop in India, which occupies about 24
per cent of gross cropped area of the country, and contributes 43 per cent to the total foodgrains production of the country. Rice is not only a rich source of carbohydrate and protein but also provides vitamins, minerals and fibres. It is cultivated in the humid tropical and subtropical climate characterized by high temperature and high relative humidity, resulting in changes in genetic integrity (Kapoor et al., 2011). The northern region of India comprising the states of Punjab, Haryana, Uttar Pradesh and Uttarakhand contributes significantly to the country's rice production due to higher productivity (Balasubramaniam and Kumar, 2010). Rice is the second largest crop grown in the state next to wheat. It occupied 21.8, 22.9 and 22.89 per cent of total cultivated area in the state during the periods of 1995-2000, 2000-05 and 2005-10, respectively.

During the period of 1995-2000, the districts which had above 40 per cent area under rice cultivation were namely, Siddharthnagar, Maharajganj, Chandauli, S.K.Nagar, Ambedkar Nagar and Mau. During the next periods of 2000-05 and 2005-10, the districts namely, Azamgarh and Deoria, respectively were added into this category. In the next category of 30-40 per cent area under rice, the numbers of districts were 16, 22 and 21, respectively during these periods. As much as 17, 12 and 11 districts were found in the category of 20-30 per cent during the corresponding periods, respectively. In the category of 10-20 per cent of area under rice cultivation, 12, 10 and 15 districts respectively were recorded, and the area cultivated below 10 per cent was occupied by 19 districts during both the previous periods. In the later period the districts were namely, Kannauj, Farrukhabad, Etah, Chitrakoot, Muzaffarnagar, Firozabad, Hathras, Meerut, Baghpat, Lalitpur, Agra, Jhansi, Jalaun, Mahoba and Hamirpur.

High growth of 20 per cent and above in area under rice was seen in 7 districts in each periods of the study. The districts included during the period of 1995-2000 to 2000-05 in this category were namely, Bulandshahr (116.35 per cent) followed by Aligarh (63.57), Ghaziabad (35.52), Kaushambi (29.99), Faizabad (27.85), Deoria (23.42), Balrampur (20.18). During the later period, the districts of Agra (146.77), G.B.Nagar (102.29), Aligarh (54.57), Bulandshahr (39.59), Hathras (27.72), Mathura (25.12) and Etawah (24.18) were included in this category. There were 38 and 26 districts, respectively, which recorded medium growth (0-20 per cent) during these periods. Low negative growth of -20 to 0 per cent was recorded in 21 and 30 districts of the state, respectively and very low negative growth of below
-20 per cent was seen in 4 and 7 districts, respectively. During later period, the districts incorporated in this category were namely, Chitrakoot (-23.09), Baghpat (-23.99), Sonbhadra (-31.60), Lalitpur (-52.87), Jalaun (-52.92), Mahoba (-73.47) and Hamirpur (-80.71).

iii. Maize

Maize occupied 1.05 million ha. (4.04 per cent), 0.86 million ha. (3.45 per cent) and 0.79 million ha. (3.17 per cent) area to the gross cultivated area in the state during 1995-2000, 2000-05 and 2005-10, respectively. The district Kannauj secured the highest acreage under maize crop during all the periods. In the next category of area devoted 15-20 per cent, there were 4, 2 and 2 districts, respectively in the corresponding periods. There were 4, 5 and 4 districts in which maize acquired 10-15 per cent area, respectively. There were 11, 10 and 9 districts during 1995-2000, 2000-05 and 2005-10, respectively in which maize was cultivated on 5-10 per cent of cropped land. Below 5 per cent of area cultivated under maize in the districts in numbering were 50, 52 and 54, respectively during the periods under consideration.

During 1995-2000 to 2000-05, high growth of above 30 per cent in area under maize was found in the districts of Kaushambi (126.33 per cent), Mahoba (105.37), Faizabad (54.79), Deoria (50.91) and Kushinagar (38.29). During the period of 2000-05 to 2005-10, three districts were found in this category namely, Jhansi (33.40), Sonbhadra (33.03) and Balrampur (31.49). In next category of medium growth (0-30 per cent), there were 16 and 10 districts, respectively included in this category during respective periods. Low growth of -30-0 per cent was recorded in 29 and 35 districts, respectively whereas, very low growth of below -30 per cent was seen in 20 and 22 districts, respectively.

iv. Pearl millet (bajra)

Bajra shared only about 3 per cent cropped area in the state during the periods of 1995-2000, 2000-05 and 2005-10. Above 20 per cent area was occupied by bajra in the districts of Agra and Firozabad during 1995-2000 and 2000-05, and district of Budaun was added within this category during 2005-10 (Appendices III, IV and V). In the next category of 15-20 per cent, the numbers of districts included were 2 and 3, respectively during the previous periods. The districts covering 10-15 per cent area was represented by 5, 4 and 6, respectively during the corresponding
period of study. The districts with 5-10 per cent of area under bajra were in number 6, 5 and 6, respectively, whereas below 5 per cent of area was seen in 55, 56 and 55 districts.

The districts recorded high growth in area under bajra were namely, Shrawasti (365.28 per cent), Siddharthnagar (133.15), Jhansi (99.26), Sonbhadra (71.19), Sitapur (56.28), Lalitpur (53.99), Ambedkar Nagar (51.34) during 1995-2000 to 2000-05, and during later period, only the district of the Banda retained a high growth. Medium growth between 0 and 50 per cent was attained by 17 and 24 districts, respectively during the corresponding periods. Low negative growth of -50 to 0 per cent was seen in 33 and 30 districts, respectively, whereas the districts with very low growth (below -50 per cent) were in number 12 and 15 in the respective periods of study. During the later period, the districts were namely, Ghaziabad, Balrampur, Lalitpur, G.B.Nagar, Meerut, Pilibhit, Ambedkar Nagar, Gorakhpur, Maharajganj, Saharanpur, Gonda, Bahraich, Muzaffarnagar, Shrawasti and Siddharthnagar.

b. Pulse crops

Pulses constitute an important component in human diet in India. They are the major source of protein for vegetarians. In comparison to cereals (wheat and rice), the percentage of protein in most pulses such as gram, urad and masoor is much higher that contains 17.1, 24.0 and 25.1 per cent respectively, whereas, wheat and rice have only 11.8 and 8.5 per cent respectively (Kachroo, 1970). Besides their nutritive value, pulse crops contain an unique property of maintaining and restoring soil fertility through biological nitrogen from the atmosphere as well as of conserving and improving physical properties of soil by virtue of their deep and well spread root system (Khanna and Gupta, 1988). In spite of these peculiarities, the area sown under pulses shows a declining trend in pulse crop producing regions of India. The reasons for such decline in area under pulses are many. First, pulses are cultivated generally on unirrigated area and poor quality land is devoted for cultivation to them. Second, the crops have not received any breakthrough with respect to high-yielding varieties of seeds. Whateoever varieties available they have narrow adaptability and highly susceptible to diseases. Third, inadequate availability of certified seeds is a major obstacle in their wide spread adoption (Sundaram, 2010; Shakeel and Hashmi, 2012). Fourth, when irrigation becomes available, farmers shift
the choice of cultivation to other more remunerative crops (Sathe and Agarwal, 2004).

Table 5.10 Area under pulse crops to gross cropped area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>1995-2000</th>
<th>2000-05</th>
<th>2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Name of district</td>
<td>No. Name of district</td>
<td>No. Name of district</td>
</tr>
<tr>
<td>Very high (Above 40)</td>
<td>5 Hamirpur, Jalaun, Mahoba, Jhansi and Lalitpur</td>
<td>7 Mahoba, Hamirpur, Jhansi, Lalitpur, Jalaun, Banda and Chitrakoot</td>
<td>6 Mahoba, Lalitpur, Hamirpur, Chitrakoot, Banda and Jhansi</td>
</tr>
<tr>
<td>High (30-40)</td>
<td>1 Banda</td>
<td>0 -</td>
<td>1 Jalaun</td>
</tr>
<tr>
<td>Medium (20-30)</td>
<td>1 Chitrakoot</td>
<td>0 -</td>
<td>2 Fatehpur and Sonbhadra</td>
</tr>
<tr>
<td>Low (10-20)</td>
<td>15 Fatehpur, Kanpur Dehat, Bahrampur, Kanpur Nagar, Varanasi, Allahabad, Gorakhpur, Banda and Chitrakoot</td>
<td>12 Fatehpur, Sonbhadra, Kanpur Dehat, Kanpur Nagar, Varanasi, Allahabad, Gorakhpur, Banda and Chitrakoot</td>
<td>8 Kausambi, Kanpur Dehat, Varanasi, Allahabad, Gorakhpur, Banda and Chitrakoot</td>
</tr>
<tr>
<td>Very low (Below 10)</td>
<td>48 Ghazipur, Lucknow, Sitapur, Etah, Bijnor, Bahawalnagar, S.S.Nagar, Ambedkar Nagar, Varanasi, Allahabad, Gorakhpur, Banda and Chitrakoot</td>
<td>51 Banda, Ballia, Shapur, Chaudhaur, Ghazipur, Lucknow, Auraiya, Varanasi, Gorakhpur, Banda and Chitrakoot</td>
<td>53 Rathnabul, Mahanagari, Kanpur Dehat, Bijnor, Ghazipur, Lucknow, Auraiya, Varanasi, Gorakhpur, Banda and Chitrakoot</td>
</tr>
</tbody>
</table>

On an average pulse crops occupied 11.02 per cent area during 1995-2000, which show a decrease to 10.81 and 9.73 per cent during 2000-05 and 2005-10, respectively, accounting for a negative growth of -1.86 and -9.98 per cent during the above study periods. It is evident from Table 5.10 that, there were 5, 7 and 6 districts which were having above 40 per cent of area under pulse crops. During 2005-10, the
districts namely, Mahoba, Lalitpur, Hamirpur, Chitrakoot, Banda and Jhansi of Bundelkhand region were included in this category. In the next category of 30-40 per cent of area under pulses, there were two districts of Banda and Jalaun to be counted in this category during 1995-2000 and 2005-10, respectively. The district of Chitrakoot acquired 20-30 per cent of area under pulses during 1995-2000 whereas, during 2005-10, there was another set of districts namely, Fatehpur and Sonbhadra to be included in this category. There were 15 districts to be included within the category of 10-20 per cent of area under pulses cultivation during 1995-2000, the number of districts decreased to 12 and 8 during later periods, respectively. Below 10 per cent area sown under pulses was seen in 48, 51 and 53 districts, respectively during the corresponding periods of study.

With respect to growth, the districts namely, Moradabad, J.P.Nagar, Budaun, Chitrakoot and Lalitpur were marked by high growth of above 20 per cent during the previous periods and during the later period three districts namely, Bahraich, Shahjahanpur and Sonbhadra were added to this category. Medium growth of 0 to 20 per cent was recorded by 11 and 8 districts, respectively in the respective periods. Low negative growth of -20 to 0 per cent was seen in 28 and 33 districts, respectively. Very low negative growth (below -20 per cent) was recorded by 26 districts during each periods, respectively (Table 5.11).

### Table 5.11 Growth in area under pulse crops in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (per cent)</th>
<th>Number of districts</th>
<th>1995-2000 to 2000-05</th>
<th>2000-05 to 2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 20</td>
<td></td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 20</td>
<td></td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Low</td>
<td>-20 to 0</td>
<td></td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -20</td>
<td></td>
<td>26</td>
<td>26</td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

### i. Gram

Gram recorded a decrease in area from 3.56 to 3.17 per cent and further to 2.50 per cent during 1995-2000 to 2000-05 and 2005-10 with a negative growth of -10.92 and -20.93 per cent, respectively. During 1995-2000, the districts of Hamirpur and Banda recorded area sown above 20 per cent under gram. Two districts of Chitrakoot and Mahoba were added in this category during the later periods. In the next category of 15-20 per cent area sown under gram, there were 4 and 2 districts, respectively during the previous periods. In the category of 10-15 per cent area sown
under gram, there were 3, 2 and 2 districts in the respective order, and in the next category of 5-10 per cent of area, 5, 4 and 7 districts were included in the corresponding periods, respectively. Below 5 per cent of area under gram, there were 48, 47 and 46 districts, respectively in the periods under consideration.

Positive growth under gram cultivated area was recorded in 8 districts namely, Chitrakoot, Mahoba, Auraiya, Jhansi, Hamirpur, Banda, Varanasi and Jalaun during 1995-2000 to 2000-05. During the later period from 2000-05 to 2005-10, the districts of J.P. Nagar, Sonbhadra, Fatehpur and Banda districts recorded positive growth. Remaining districts have shown negative growth during the periods under consideration.

ii. Lentil (masoor)

Masoor is a pulse crop which shared 2.26 per cent area in cultivation to the total cultivated area of the state during 2005-10, as compared to 2.09 and 2.43 per cent during 1995-2000 and 2000-05, respectively, recording a positive growth of 16.39 per cent during 1995-2000 to 2000-05 but a negative growth to the tune of -7.24 per cent during 2000-05 to 2005-10 per cent. The districts in which masoor occupied above 10 per cent of area during 1995-2000 were namely, Shrawasti, Bahraich, Jalaun and Hamirpur. During 2000-05, the district of Banda was added within this category, and during the period of 2005-10, the district of Chitrakoot replaced Jalaun. In the next category of 8-10 per cent of area, there were 2, 3 and 3 districts, respectively. An area of 6-8 per cent under this crop was seen in 3, 2 and 2 districts in the respective periods. There were 2, 4 and 5 districts, respectively to show 4-6 per cent of area, whereas, 59, 56 and 55 districts recorded below 4 per cent of area under the cultivation of masoor, respectively during the periods under consideration.

During the period of 1995-2000 to 2000-05, there were 41 districts to record a positive growth in masoor cultivated area, as against 21 districts during 2000-05 to 2005-10. The number of districts to show high growth of above 50 per cent in area was seen in 20 districts during the previous period, the number decreased from 20 to 5 in this category during the later period of study. Medium growth was recorded by 21 and 16 districts in respective periods. Low negative growth of -50 to 0 per cent was seen in 25 and 43 districts, respectively whereas, very low negative growth (below -50 per cent) was recorded in 4 and 6 districts, respectively.
iii. Black gram (*urad*)

*Urad* occupied less than 2 per cent area in cultivation in the state. The district of Lalitpur recorded highest area of 11.09, 20.85 and 22.89 per cent, respectively during the periods of 1995-2000, 2000-05 and 2005-10. There were 44, 42 and 44 districts, respectively which had less than 1 per cent of area under this crop. In a range of 1-2 per cent area under *urad*, there were 10, 12 and 9 districts, respectively. In between 2 and 3 per cent of area, there were 8, 5 and 6 districts, respectively. Whereas, in 3, 5 and 5 districts, this crop acquired 3-4 per cent of area sown, and above 4 per cent of area was recorded in 5, 6 and 6 districts, respectively.

During the period of 1995-2000 to 2000-05, there were 14 districts of the state namely, Moradabad, J.P.Nagar, Budaun, Rampur, Jalaun, Bareilly, Jhansi, Lalitpur, Mahoba, Hamirpur, Ghaziabad, Unnao, Varanasi and Kaushambi which recorded a high growth of above 50 per cent in *urad* cultivated area. During the later period, Rampur and Mahoba recorded a high growth. Between 0 and 50 per cent growth was recorded in 21 and 22 districts of the state. Low growth was recorded in 29 and 44 districts, respectively. Whereas, very low growth (below-50 per cent) was seen in 6 and 2 districts in the respective periods of the study.

iv. Pigeon pea (*arhar*)

Cultivation of *arhar* was dominant in the districts namely, Chitrakoot, Sonbhadra, Kaushambi, Fatehpur, Hamirpur, Banda, Mirzapur and S.R.Nagar during 2005-10. During previous periods, the numbers of districts were counted as 7 and 6, respectively. These districts covered above 4 per cent area under *arhar*. In the next categories of 3-4 per cent and 2-3 per cent of area, numbers of districts were counted as 8, 5 and 2, and 18, 12 and 11 in the corresponding periods, respectively. In the other categories of 1-2 per cent and below 1 per cent of area, the number of districts was 18, 25 and 16, and 19, 22 and 33 in the respective periods.

High growth of above 50 per cent in area under *arhar* was recorded by the districts namely, J.P.Nagar and Banda in respective periods of growth. Medium growth was seen in 12 and 17 districts, respectively. In the category showing low growth, there were 47 and 44 districts, respectively during the periods of study, whereas, very low negative growth of below -50 per cent was recorded in 10 and 8 districts during the respective periods.
v. Green gram (moong)

Moong has emerged as the most neglected pulse crop in the state, which acquired only less than 0.5 per cent area to the gross cropped area during all the periods of study. The districts of Mahoba, Unnao, Jhansi, Rae Bareli and Etawah were the only districts to show area sown in order of 2.68, 1.52, 1.21, 1.19 and 1.03 per cent during 2005-10.

c. Oilseed crops

Oilseeds covered a very small proportion of area some 3.96, 3.08 and 3.70 per cent to gross cropped area in the state during 1995-2000, 2000-05 and 2005-10, respectively. During 1995-2000, the districts of Agra (24.56 per cent), Mathura (14.16), Jhansi (13.11), Hathras (10.87) and Kanpur Dehat (10.16) acquired above 10 per cent of area under oilseeds, and during 2000-05, the districts of Agra and Bahraich with 19.78 and 12.33 per cent area included within this category whereas, during 2005-10, the districts of Jhansi, Agra, Jalaun and Mathura were incorporated in this category with 21.68, 15.92, 13.90 and 11.37 per cent of area under oilseeds, respectively. With 7 to 10 per cent area under oilseed cultivation were counted in number as 7, 4 and 2 districts in the respective periods. Within the range of 4-7 per cent of area, there were 12, 17 and 16 districts respectively, during 1995-2000, 2000-05 and 2005-10. In the category of 1-4 per cent and below 1 per cent of area, there were 29, 27 and 32, and 17, 20 and 16 districts, respectively of the state (Table 5.12).

With regard to the growth of area under oilseeds, the districts namely, Bahraich, Faizabad, Deoria and Varanasi recorded a high growth of above 20 per cent during the period of 1995-2000 to 2000-05. In the later period, there were 20 districts included in this category, among them, the districts namely, Jalaun, Hamirpur, Jhansi, Budaun and Varanasi achieved the highest growth. Medium growth of 0-20 per cent was recorded by 8 and 20 districts, respectively. Low growth was recorded by 26 districts in each period of study. Whereas, very low growth (below -20 per cent) was in 32 and 4 districts of the state in the respective periods (Table 5.13).

i. Mustard and Rapeseed

Mustard and Rapeseed are important oilseed crops grown in the state and covered significant area with proportions being 2.91, 2.25 and 2.37 per cent during
Table 5.12 Area under oilseed crops to gross cropped area in Uttar Pradesh

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Name of district</td>
<td>No.</td>
<td>Name of district</td>
</tr>
<tr>
<td>Very high (Above 10)</td>
<td>5</td>
<td>Agra, Mathura, Haridwar, and Kanpur</td>
<td>2</td>
</tr>
<tr>
<td>High (7-10)</td>
<td>7</td>
<td>Pirozibad, Auraiya, Kanpur, and Hardoi</td>
<td>4</td>
</tr>
<tr>
<td>Low (1-4)</td>
<td>29</td>
<td>Budhnan, Sambhodha, Bareilly, Rae Bareli, Kushinagar, Hamirpur, Bareil, Bareli, Mansa, Pilibhit, Rampur, Farrukhabad, Bareil, Lucknow, Gorakhpur, and S.K.Nagar</td>
<td>27</td>
</tr>
<tr>
<td>Very low (Below 1)</td>
<td>17</td>
<td>Deoria, Meerut, Sultanpur, Faizabad, Pratapgarh, J.P.Nagar, Baghat, S.R.Nagar, Allahabad, Muzaffarnagar, Jaunpur, Main, Varanasi, Balia, Azamgarh, Chandauli, and Ghazipur</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

Table 5.13 Growth in area under oilseed crops in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (per cent)</th>
<th>1995-2000 to 2000-05</th>
<th>2000-05 to 2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 20</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 20</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Low</td>
<td>-20 to 0</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -20</td>
<td>32</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.
1995-2000, 2000-05 and 2005-10, respectively. The district of Agra recorded the highest area of 24.09, 19.47 and 15.54 per cent under these crops during the corresponding periods, followed by the districts of Mathura, Kanpur Dehat, Etawah, Auraiya, Balrampur and Kanpur Nagar whereas, the lowest area was in the district of Mau (0.06 per cent) during all the periods. During 1995-2000 and 2000-05, there were as much as 14 districts which recorded a positive growth and during the later period, the number of districts increased from 14 to 44 in which, Lalitpur, Jhansi, Budaun and Hamirpur recorded the highest growth (above 50 per cent). Remaining districts of the state recorded a negative growth.

d. Cash crops

Sugarcane and potatoes selected constitute important cash crops in the state. Sugar is probably an indigenous crop to India, the name of the crop itself comes from Sanskrit language. In terms of raw cane, India is the largest producer in the world, but the low saccharine content of the cane due to poor technique of extraction brings its output in terms of sugar at third place, after the countries of Cuba and Brazil (Spate and Learmonth, 1967). Sugarcane occupies about 3.0 per cent of the total cultivated area in the state, and it is one of the most important cash crops, contributing about 7.5 per cent of the gross value of agricultural production in the country. Potatoes are the world's fourth important food crop after wheat, rice and maize because of their yield potentials and high nutritive value.

Potatoes constitute nearly half of the world’s annual output of all root and tuber crops. With an annual global production of about 300 million tonnes, potatoes are economically important staple crop in developed and developing countries. India ranks fourth in area and third largest country in the world in production of potatoes after China and Russian Federation. About 90 per cent of the potato crops in India are cultivated in Ganga plain, the period of cultivation spans over the months of October until February-March.

It is seen from Table 5.14 that, during 1995-2000, 2000-05 and 2005-10, there were 9, 9 and 10 districts, respectively which devoted above 20 per cent area under cash crops to gross cropped area. During 2005-10, area devoted more than 20 per cent under cash crops in the districts were namely, Bijnor (49.32), Muzaffarnagar (49.19), Meerut (45.32), Baghpat (42.43), Sabaranpur (33.60), Kheri (31.27), J.P.Nagar (29.56), Ghaziabad (29.54), Kushinagar (20.69) and Sitapur (20.19). In the
### Table 5.14 Area under cash crops to gross cropped area in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>1995-2000</th>
<th>2000-05</th>
<th>2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Name of district</td>
<td>No.</td>
</tr>
<tr>
<td>Very high (Above 20)</td>
<td>9</td>
<td>Bijnor, Muzaffarnagar, Meerut, Baghpat, J.P.Nagar, Saharanpur, Khair, Ghaziabad and Kushinagar</td>
<td>9</td>
</tr>
<tr>
<td>High (15-20)</td>
<td>3</td>
<td>Moradabad, Sitapur and Bareilly</td>
<td>4</td>
</tr>
<tr>
<td>Medium (10-15)</td>
<td>4</td>
<td>Farrukhabad, Kannauj, Pillibhit and Shahjahanpur</td>
<td>7</td>
</tr>
<tr>
<td>Low (5-10)</td>
<td>18</td>
<td>Bulandshahr, Rampur, Ambedkar Nagar, Badal, Barabanki, Budaun, Firozabad, Azamgarh, Mau, Mahanaghat, Ghazipur, Jaunpur, Balia, Deoria, Hardoi, Bulandshahr, Farrukhabad and Hardoi</td>
<td>14</td>
</tr>
</tbody>
</table>

**Source:** Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

### Table 5.15 Growth in area under cash crops in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>Range (Per cent)</th>
<th>Number of districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 20</td>
<td>12</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 20</td>
<td>26</td>
</tr>
<tr>
<td>Low</td>
<td>-20 to 0</td>
<td>20</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -20</td>
<td>12</td>
</tr>
</tbody>
</table>

**Source:** Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

next category of area under cash crops 15-20 per cent, there were 3, 4 and 5 districts in the corresponding periods of time. In between 10 and 15 per cent area under cash

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crops it was seen in 4, 7 and 7 districts, respectively. Whereas, 5-10 per cent area under cash crops was devoted in 18, 14 and 10 districts of the state during the periods under consideration, respectively. Below 5 per cent of area under cash crops was seen in 36, 36 and 38 districts during these periods, respectively. Lowest area under cash crops occurred only in Jhansi, Lalitpur, Banda and Chitrakoot districts of Bundelkhand region of the state.

In terms of growth in area under cash crops, there were 12 and 11 districts, respectively which registered high growth of more than 20 per cent during the periods of study (Table 5.15). During later period, the districts showing high growth were namely, Hathras, Agra, Etawah, Mahoba, Shravasti, Firozabad, Aligarh, Gonda, Banda, Balrampur and Sonbhadra. Medium growth in area under cash crops was recorded in 26 and 27 districts, respectively and low growth was in 20 and 26 districts, respectively during both the periods of study. Very low growth (below -20 per cent) was recorded by 12 and 6 districts, respectively.

1. Sugarcane

The state of Uttar Pradesh occupied first place both in area and production of sugarcane in the country, followed by the state of Maharashtra, Tamil Nadu, Karnataka and Andhra Pradesh. It accounted for 42.47 per cent of total area and 41.31 per cent of total production of sugarcane in the country. The maximum concentration of sugarcane cultivation is seen in the upper Ganga-Yamuna doab, Rohilkhand and the trans-Saryu plain which together account for 70 per cent of the state's production. Amongst 100 leading sugarcane producing districts of the country, 33 belong to the state of Uttar Pradesh (Raja, 2012).

Within the state, the western region is considered to be the dominant producer of sugarcane. In 1995-96, it produced over 80 million tonnes of sugarcane, while the eastern region less than 13 million tonnes. This has been due to that, the western region devoted an area under sugarcane almost 5 times the area under this crop in the eastern region (1.2 million ha. vs. 0.25 million ha.), and about 97 per cent of this area in the west was irrigated, whereas less than 90 per cent was irrigated in the east (Bajpai and Volavka, 2005; Asawa, 2005).

Sugarcane occupied about 8 per cent area among the cultivated crops in the state during the study periods. Very high concentration of the crop, above 10 per cent of cultivated area, was seen in 13, 17 and 17 districts, respectively of the state during
1995-2000, 2000-05 and 2005-10. Districtwise concentration of the crop during 2005-10 was highest in Bijnor (49.14 per cent), Muzaffarnagar (48.75), Meerut (43.50), Baghpat (42.29), Saharanpur (33.48), Kheri (31.09), J.P.Nagar (28.33), Ghaziabad (27.50), Kushinagar (20.23), Sitapur (19.59), Balrampur (17.30), Bareilly (14.88), Pilibhit (14.73), Gonda (14.40), Basti (12.30), Moradabad (12) and Bulandshahr (10.70). In the category of 8-10 per cent of area under cultivation, there were 2, 1 and 2 districts which were recorded in the respective periods. Within the category of area 4-6 per cent, the number of districts were in order of 6, 7 and 4 in the corresponding periods, respectively, whereas below 4 per cent of area it was seen in 47, 44 and 47 districts, respectively.

During the period of 1995-2000 to 2000-05, high growth of above 20 per cent in area under sugarcane was recorded in 11 districts, the number of districts decreased to 7 during the later period. These districts were namely, Shrawasti (70.86 per cent), Mahoba (66.96), Gonda (41.13), Hardoi (28.15), Banda (25.84), Balrampur (23.15) and Ambedkar Nagar (21.74). Medium growth (0 to 20 per cent) was recorded by 18 and 17 districts, respectively during the corresponding periods whereas, low negative growth (-20 to 0 per cent) was attained in 18 and 29 districts, respectively. Very low negative growth was recorded in 23 and 17 districts of the state during the periods of study.

ii. Potatoes

Potatoes occupied less than 2 per cent area of the total cropped area in the state. The districts namely, Kannauj, Hathras, Farrukhabad, Firozabad and Agra recorded the highest concentration of potatoes during all the periods (Appendices III, IV and V). All of the districts belong to the most fertile Ganga-Yamuna doab region of the state. Comparatively, the lowest area under potatoes was seen in the districts belong to Bundelkhand and Baghelkhand regions of the state.

As regards the growth of area under potatoes, the districts of Agra and Hathras showed a high growth of 71.25 and 50.18 per cent during 1995-2000 to 2000-05, respectively. The district of Aligarh recorded highest growth of 110.09 per cent during later period of study, followed by the districts of Hathras (103.06), Etawah (74.20), Agra (73.34), Banda (62.24), Jalaun (57.67), Mathura (56.99) and Firozabad (50.17). Medium growth between 0 and 50 per cent was recorded by 20 and 27 districts, respectively. Whereas, low negative growth (-50 to 0 per cent) was recorded in 23 and 17 districts of the state during the periods of study.
seen in 47 and 35 districts during the corresponding periods of study, respectively. Very low negative growth was attained by the district of Kanpur Dehat (-51.69 per cent) during 1995-2000 to 2000-05.

C. Trends of Growth in Area, Production and Yield of Crops: 1995-96 to 2009-10

India has registered very significant increase in area and production of crops and in yield of the crops per hectare during the last three-four decades. The entire credit goes to new agricultural technology incorporated in Indian farming in the form of green revolution which played vital role in heralding new era of transformation agricultural arena (Misra and Kumar, 2007). The gains in agricultural production that went along with the introduction of new technology lifted India from the status of a food deficient country to a self sufficient one. The modern methods of irrigation and seed-fertilizer technology that came through agricultural research and development made it possible to increase crop yields, enabling the farmers to use existing land more efficiently. The increase in yields and agricultural productivity in rural areas have translated into development gains for the rural poor (Bajpai and Volavka, 2005).

Moreover, growth rates per annum in area, production and yield of major crops, viz., cereals, pulses, oilseeds and cash crops were computed applying the linear regression (least square growth rate) formula for a period of fifteen years, i.e. from 1995-96 to 2009-10. Appendices VI, VI and VIII give the districtwise values of growth rates of the crops considered in the state.

a. Trends of growth in area, production and yield under cereal crops

Area

Total area devoted to cereal crops during 1995-96 was 17.23 million ha. It decreased to 17.05 million ha. during 2009-10. The area under cereals showed a negative growth rate of -0.11 per cent/annum. During this period, there were 35 districts which recorded positive growth, while remaining districts showed a negative growth. A single district Kanpur Nagar characterized with very high growth of 4.89 per cent/annum (Table 5.16 and Fig. 5.7). On the other hand, 6 districts namely, Shrawasti (-2.97 per cent/annum), Meerut (-3.18), G.B.Nagar (-3.20), Sonbhadra (-3.78), Varanasi (-4.22) and Farrukhabad (-4.37) recorded very low negative growth of below -2.75 per cent/annum. A total of 23 districts recorded high growth
which ranged between 0.48 and 2.09 per cent. In all, 25 districts recorded medium growth between -1.14 and 0.48 per cent, whereas, 15 districts registered a low growth between -2.75 and -1.14 per cent.

Production

The production of cereal crops in the state increased from 35.85 million tonnes during 1995-96 to 41.60 million tonnes during 2009-10, thus giving a growth rate of 0.63 per cent/annum. During this period, there were 42 districts which recorded a positive growth and the remaining districts were characterized with a negative growth. To classify the districts into different category of growth, there emerged five grades. The highest growth in production of cereals was recorded in Kanpur Nagar, being 5.22 per cent, and the lowest in Varanasi with -5.53 per cent, followed by the districts of Sonbhadra (-4.80 per cent/annum), Mahoba (-4.28), Farrukhabad (-3.89) and Chitrakoot (-3.10). High growth in between 1.15 and 3.12 per cent per annum was recorded by 22 districts. The medium growth in between -0.81 and 1.15 per cent/annum was seen in 28 districts, and 14 districts were characterized with low negative growth that ranged between -2.77 and -0.81 (Table 5.16 and Fig. 5.7).

Yield

Districtwise growth of yield of cereals shows that, during this period, the state recorded 0.74 per cent annual growth. During this period, very high growth was recorded by the districts of Balrampur, Bahraich, Unnao and Shrawasti in order of 2.37, 2.32, 2.14 and 2.10 per cent, respectively. High growth in between 0.98 and 1.92 per cent was attained by 16 districts whereas, 34 districts recorded medium growth in between 0.40 and 0.98 per cent. Low growth in yield of cereals was visible in 9 districts. The districts of Chitrakoot (-3.10), Farrukhabad (-3.89), Mahoba (-4.28), Sonbhadra (-4.80) and Varanasi (-5.53) were characterized with very low growth in yield of cereals (Fig. 5.7).

i. Wheat

Area

Appendix VI shows the growth rate per annum in area under individual crops. Among them wheat shows an increase in area from 8.92 million ha during 1995-96 to 9.51 million ha in 2009-10 recording a growth rate of 0.32 per cent/annum. Kampur
Table 5.16 Growth rate per annum in area, production and yield of cereal crops in Uttar Pradesh: 1995-96 to 2009-10

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (per cent)</th>
<th>No.</th>
<th>Area</th>
<th>Production</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Above 2.09</td>
<td>1</td>
<td>Kanpur Nagar</td>
<td>Above 1.12</td>
<td>Kanpur Nagar</td>
</tr>
<tr>
<td>High</td>
<td>0.48 to 2.09</td>
<td>23</td>
<td>Jalaun, Mathura, Kushinj, Ambasthan Nagar, Amroha, Unnao, Balrampur, Pratapgarh, Gorakhpur, Mau, Hathras, Aligarh, Khair, S.K. Nagar, Mahoba, Bahraich, Lucknow, Bhadohi, Bulandshahr, Patiyala, Pinapur, Rana Bari, Karauli, Sambhal and Muzaffarnagar</td>
<td>1.15 to 3.12</td>
<td>22</td>
</tr>
<tr>
<td>Medium</td>
<td>-1.14 to 0.48</td>
<td>25</td>
<td>Ballia, Mathura, Kausambi, Ambasthan Nagar, Amroha, Unnao, Balrampur, Pratapgarh, Gorakhpur, Mau, Hathras, Aligarh, Khair, S.K. Nagar, Mahoba, Bahraich, Lucknow, Bhadohi, Bulandshahr, Patiyala, Pinapur, Rana Bari, Karauli, Sambhal and Muzaffarnagar</td>
<td>0.81 to 1.15</td>
<td>28</td>
</tr>
<tr>
<td>Low</td>
<td>-2.75 to -1.14</td>
<td>15</td>
<td>Muzaffarnagar, Sultanpur, J.P.Nagar, Kanpur Dehat, Bandu, Ghazibad, Allahabad, Faizabad, Saharanpur, Mahoba, Chitrakoot, Gorakhpur, Chauka, Hamirpur and Basti</td>
<td>-2.77 to -0.81</td>
<td>14</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -2.75</td>
<td>6</td>
<td>Sultanpur, Meerut, G.B. Nagar, Saharanpur, Varanasi and Farrukhabad</td>
<td>Below -2.77</td>
<td>5</td>
</tr>
</tbody>
</table>

*Source: Office of Agricultural Statistics, Uttar Pradesh, Department of Agriculture, Lucknow.*
Growth in Area, Production and Yield of Cereal Crops

1995-96 to 2009-10

Name of district

Uttar Pradesh

Growth rate (per cent/annum)
Nagar, Jalaun and Siddharthanagar with 4.93, 2.87 and 2.45 per cent/annum recorded very high growth in area whereas, very low growth (below -2.15 per cent/annum) was attained by the districts of Basti (-2.27), G.B.Nagar (-2.35), Meerut (-2.67), Shrawasti (-3.43), Varanasi (-3.57) and Farrukhabad (-3.89). High, medium and low growth rate per annum was recorded by 23, 25 and 13 districts, respectively.

**Production**

Production of wheat crop jumped from 21.81 to 27.02 million metric tonnes, with an increase of 1.15 per cent during the same period. In terms of growth rate of production, Kanpur Nagar recorded very high growth of 5.18 per cent/annum. High growth rate between 1.64 and 3.44 per cent were characterized with as many as 24 districts whereas, 25 districts showed medium growth of -0.17 to 1.64 per cent/annum. Low negative (-1.97 to -0.17 per cent/annum) and very low negative growth (below -1.97 per cent/annum) in production of wheat was achieved by 12 and 8 districts, respectively.

**Yield**

Average yield per hectare of wheat shows an increase of 0.82 per cent/annum during the period of 1995-96 to 2009-10. Very high growth rate of above 1.98 per cent/annum was recorded in Balrampur (3.19 per cent), Sonbhadra (2.64), Kheri (2.26) and Bahraich (2.04) districts of the state. High growth of 1.06 to 1.98 per cent was seen in 11 districts namely, Barabanki, Pilibhit, Unnao, Sitapur, Hamirpur, Shahjahanpur, Shrawasti, Rae Bareli, Lucknow, Hardoi and Kanpur Dehat. Whereas, during the same period, medium (0.15 to 1.06 per cent/annum) and low growth (-0.77 to 0.15 per cent/annum) in yield/ha were attained by 40 and 14 districts, respectively. Very low growth (below -0.77 per cent/annum) was recorded by Mahoba district (-2.71 per cent).

**ii. Rice**

**Area**

During the period of 1995-96 to 2009-10, there has been a marginal increase of 0.06 per cent/annum in area under rice. The districts of Bulandshahr, Agra and Aligarh recorded very high growth of above 6.26 per cent/annum in area. This was followed by high growth of 1.84 to 6.26 per cent/annum in the districts of G.B.Nagar, Hathras, Kanpur Nagar, Mathura, Ghazinbad, Kaushambi, Hardoi,
Shahjahanpur, Balrampur and Jaunpur. Whereas, medium growth (-2.59 to 1.84 per cent/annum) in area under rice was seen in 46 districts. Low and very low growth were recorded in 7 and 4 districts, respectively. These were 11 districts marked with negative growth namely, Basti (-2.71 per cent), Muzaffarnagar (-3.15), Saharanpur (-3.32), Baghpat (-3.53), Chitrakoot (-4.50), Varanasi (-4.80), Sonbhadra (-6.67), Lalitpur (-7.28), Jalaun (-10.07), Mahoba (-13.47) and Hamirpur (-19.80).

**Production**

Production of rice has recorded 0.12 per cent/annum increase during 1995-96 to 2009-10. The districts namely, Bulandshahr (11.03 per cent), Aligarh (10.83) and Agra (10.23) have recorded a very high growth in production of rice during this period. High growth between 2.29 and 7.53 per cent/annum for rice was recorded in the districts namely, Mathura, Firozabad, Kanpur Nagar, Jhansi, G.B.Nagar, Ghaziabad, Kaushambi, Hathras, Hardoi, Balrampur, Mainpuri and Aumiya whereas, medium and low growth during the same period were seen in 42 and 6 districts, respectively. Very low growth in negative order below -8.18 per cent was recorded by the districts namely, Varanasi, Jalaun, Lalitpur, Sonbhadra, Chitrakoot, Mahoba and Hamirpur.

**Yield**

Growth in average yield of rice in the state was marginal with 0.06 per cent/annum during this period. It recorded very high growth of 6.13 and 5.38 per cent in the districts namely, Jhansi and Firozabad, respectively. This was followed by 17 districts which were characterized with high growth. Medium and low growths were recorded in 34 and 13 districts, respectively. Whereas, the districts namely, S.R.Nagar (-2.92 per cent), Sonbhadra (-4.25), Varanasi (-4.25) and Chitrakoot (-6.48) showed very low growth during this period.

**Maize**

**Area**

Maize crop recorded a decrease of -2.66 per cent/annum in area from 1.08 million ha. during 1995-96 to 0.71 million ha. during 2009-10. The districts namely, Mahoba, Kaushambi and Kanpur Nagar recorded very high growth of 14.55, 9.68 and 8.35 per cent, respectively. High growth between -1.50 and 6.75 per cent/annum was noticed in total of 16 districts. Medium growth (-9.75 to -1.50 per cent) was
visible in 37 districts. Low growth in between -18.0 and -9.75 per cent was seen in 9 districts. Muzaffarnagar (-21.57), G.B.Nagar (-21.92), Meerut (-23.58), Bijnor (-27.26) and Baghpat (-39.04) were marked with very low growth of below -18.0 per cent/annum.

Production

In the state, it showed a negative growth per annum to the tune of -2.03 per cent during 1995-96 to 2009-10. Very high growth was recorded in the districts of Mahoba (15.95), Kaushambi (11.88) and Kushinagar (9.57) during this period. Whereas, high, medium, and low growth rates were seen in 15, 37 and 9 districts, respectively. Very low growth was recorded in the districts namely, Meerut (-20.62 per cent), Shrawasti (-21.11), G.B.Nagar (-21.31), Muzaffarnagar (-22.37), Bijnor (-22.45) and Baghpat (-37.90).

Yield

Average yield of maize showed a positive growth of 0.65 per cent/annum in the state. The districts namely, Maharajganj, Mahoba, Agra and Bareilly with the growth values of 10.81, 10.80, 9.66 and 9.02 per cent, respectively showed very high growth whereas, 6 districts namely, Mirzapur (-4.43), S.R.Nagar (-5.50), Barabanki (-5.88), Jhansi (-6.84), Hamirpur (-7.71) and Shrawasti (-12.90) recorded very low negative growth during this period. There were as many as 16, 32 and 12 districts which were characterized with high, medium and low growth, respectively.

iv. Pearl millet (bajra)

Area

Bajra showed positive growth of 0.53, 2.29, and 1.75 per cent/annum in area, production and yield during 1995-96 to 2009-10. During this period, very high growth in area was seen in the districts of Jhansi and Kanpur Nagar with 14.40 and 13.30 per cent/annum, respectively. Very low negative growth of below —17.50 per cent/annum in area under bajra was seen in Ghaziabad, Pilibhit, Gorakhpur, S.K.Nagar, Shrawasti, Meerut, Siddharthnagar, Bahraich, Bijnor and Gonda districts.

Production

In terms of production of bajra, the districts of Kanpur Nagar and Jhansi were also listed on top. Very low negative growth in production of bajra was seen in
the districts of Meerut (-17.60), Gorakhpur (-19.12), S.K.Nagar (-20.58), Bhabraich (-21.35), Shrawasti (-23.06), Gonda (-23.20), Bijnor (-24.31) and Siddharthnagar (-25.05).

Yield

The districts namely, Ghazipur, Mainpuri, Pilibhit, Kannauj, Ballia, Mau, Azamgarh, Meerut, Hamirpur, Ghaziabad, Kanpur Nagar, Sultanpur, Barabanki, Ambedkar Nagar, Fatehpur, Ballarpur, Auraiya and Bulandshahr attained a high growth of above 2.78 per cent/annum during this period. Very low negative growth was recorded in the districts of Shrawasti (-9.09), Bijnor (-9.77), Lalitpur (-15.67), Maharajganj (-21.68) and Siddharthnagar (-22.86) during this period.

v. Sorghum (jowar)

Other cereal crops (jowar and barley) recorded a negative growth in area and production whereas, the growth in yield of jowar was positive (0.35 per cent/annum) during this period. Very high growth in area and production of jowar was achieved by Basti district (15.73 and 14.08 per cent/annum). The districts namely, Basti (10.60), Kaushambi (9.52), and Aligarh (6.88) recorded a very high growth in yield of jowar during this period. Comparatively, very low negative growth in area of jowar was seen in the districts of Ghaziabad (-27.85), Etah (-29.56), J.P.Nagar (-31.33), Pilibhit (-34.22) and G.B.Nagar (-37.36). In the districts namely, Gorakhpur (-23.27), Etah (-25.64), Ghaziabad (-26.55), J.P.Nagar (-30.14), Pilibhit (-32.56) and G.B.Nagar (-38.60) growth in production of jowar was lowest. The districts of Hamirpur, Pilibhit and J.P.Nagar with -5.67, -6.35 and -14.78 per cent/annum showed a negative lowest growth in yield during this period.

vi. Barley

The districts of Lalitpur and Shahjahanpur with 5.27 and 3.82 per cent/per annum showed very high growth in area under barley, whereas the districts of Lalitpur (7.43), Chaudhali (5.91), Shahjahanpur (4.64) and Jhansi (3.91) recorded a very high growth in production. Growth in yield of barley was highest in the district of Chaudhali (3.50 per cent/annum), and the districts namely, Chitrakoot, Kaushambi, S.R.Nagar, Mirzapur, Hamirpur, Mahoba and Banda recorded a very low growth in yield during the corresponding period.
b. Trends of growth in area, production and yield under pulse crops

Area

Area, production and yield of pulse crops in the state show a declining rate of -1.46, -2.17 and -0.71 per cent/annum during the period from 1995-96 to 2009-10. Table 5.17 and Fig. 5.8 show that the districts which showed very high growth in area under pulses were namely, Moradabad (8.35), Kanpur Nagar (5.35), Chitrakoot (5.24), Lalitpur (4.60), J.P.Nagar (4.34) and Mahoba (2.65). High growth in area was recorded by 10 districts, whereas medium and low growths were seen in 31 and 19 districts during this period. Very low negative growth was visible in the districts namely, Mathura (-9.59), Etawah (-9.68), Etah (-10.20) and Agra (-11.42).

Production

In production of pulses, very high growth was seen in the districts of Moradabad (9.36 per cent/annum), followed by J.P.Nagar (6.20), Lalitpur (5.11), Kanpur Nagar (3.99) and Shahjahanpur (3.32). High growth between -1.36 and 2.86 per cent/annum was recorded in 12 districts, whereas 28 districts recorded moderate growth (-5.58 to -1.36 per cent/annum). Low negative growth in production of pulses was registered by 22 districts. The districts namely, Etah (-10.93), Etawah (-11.06) and Agra (-15.95) were at the bottom to show a negative growth during this period (Fig. 5.8).

Yield

Out of 70, about 50 per cent districts recorded a positive growth in yield of pulses during 1995-96 to 2009-10. Very high growth was seen in the districts of Balrampur (3.85 per cent/annum) and Shahjahanpur (3.03) during this period (Table 5.17 and Fig. 5.8). High and medium growth rates were visible in 20 and 32 districts. The districts namely, Auraiya, Kanpur Nagar, Etawah, Jhansi, Muzaffarnagar, Pratapgarh, Shahjahanpur, Fatehpur, S.R.Nagar and Hamirpur recorded low growth in between -2.80 and -1.03 per cent/annum. Very low growth (below -2.80 per cent) was observed in the districts namely, Banda (-2.86), Allahabad (-3.30), Mahoba (-4.01), Kaushambi (-4.55), Chitrakoot (-4.85) and Agra (-5.11).
## Table 5.17 Growth rate per annum in area, production and yield of pulse crops in Uttar Pradesh: 1995-96 to 2009-10

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (per cent)</th>
<th>Area</th>
<th>No.</th>
<th>Name of district</th>
<th>Range (per cent)</th>
<th>Production</th>
<th>No.</th>
<th>Name of district</th>
<th>Range (per cent)</th>
<th>Yield</th>
<th>No.</th>
<th>Name of district</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Above 2.61</td>
<td>6</td>
<td></td>
<td>Moradabad, Kanpur Nagar, Chitrakoot, Lilibpur, JP Nagar and Mahoba</td>
<td>Above 2.86</td>
<td>5</td>
<td>Moradabad, JP Nagar and Sahippur</td>
<td>Above 2.86</td>
<td>2</td>
<td>Dalrampur and Shahippur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>-1.36 to 2.51</td>
<td>10</td>
<td></td>
<td>Brahmavat, Ueran, Fautipur, Chitrakoot, Shilphpanpur, Kanpur, Bahundandi, Kanpur and Sahulpada</td>
<td>-1.36 to 2.86</td>
<td>12</td>
<td>Brahmavat, Conraduli, Ballia, Uran, Dalrampur, Chitrakoot, Berhampur, Baghpat, Sootshanda, Jalan, Patelpur and Bahundandi</td>
<td>0.74 to 2.59</td>
<td>20</td>
<td>Ballia, G.B. Nagar, Ho录取, Kerai, Medhara, JP Nagar, Gorpurap, Pilibhit, Haibala, Mairanpur, Bolkhandi, Bijpur, Lucknow, Gonda, Haroli, Ambodhia Nagar, Moradabad, Brahmavat, Baghpat and Sahulpada</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>-9.27 to -5.31</td>
<td>19</td>
<td></td>
<td>G.B. Nagar, Maharanjag, Bari, Deoria, Pahiro, Varanasi, Kumauni, Muzafarnagar, Meerut, Siddharthnagar, Firozpur, Bijapur, Allahabad, Meerut, Gonda, Gorakhpur, Farahabad, Hardinpur, Feulakand and Gorakhpur</td>
<td>-9.81 to -5.36</td>
<td>22</td>
<td>Pilibhit, S.R. Nagar, Pratapgarh, Firozpur, Bijapur, Maharanjag, Vaisali, Deoria, Meerut, Siddhikharwar, Allahabad, Kumauni, Sahulpur, Meerut, Allah, Hardinpur, Gonda, Gorakhpur, Muzafarnagar, Firozpur and Firozabad</td>
<td>-2.80 to -1.03</td>
<td>19</td>
<td>Amulaya, Kumper Nagar, Etawah, Jhansi, Muzafarnagar, Pratapgarh, Sahulpur, Pilibhit, S.R. Nagar and Haridwar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very low</td>
<td>Below -9.27</td>
<td>6</td>
<td></td>
<td>Mathura, Etawah, Bari and Agar</td>
<td>Below -9.81</td>
<td>3</td>
<td>Etawah, Etawah and Agar</td>
<td>Below 2.80</td>
<td>6</td>
<td>Buda, Allahabad, Maukha, Raisabidi, Chitrakoot and Agar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various issues), Director of Agriculture, Lucknow.
Growth in Area, Production and Yield of Pulse Crops
1995-96 to 2009-10
i. Black gram (urad)

Area

Urad recorded a positive growth per annum in area (3.50 per cent), production (4.39 per cent) and yield (0.86 per cent) during 1995-96 to 2009-10, respectively. The districts namely, Rampur, Moradabad, Mahoba, Lalitpur, Budaun, J.P.Nagar, Kanpur Nagar and Bareilly achieved very high growth of above 9.30 per cent/annum in area under urad crop during this period. High growth in between 2.34 and 9.30 per cent/annum was recorded by 8 districts. There were 34 and 17 districts, respectively to show medium (-4.62 to 2.34 per cent/annum) and low (-11.57 to -4.62 per cent/annum) growths during this period. The districts belonging to Purvanchal region namely, Deoria (-14.28), Gorakhpur (-14.31) and S.K.Nagar (-21.35) recorded a very low negative growth during this period.

Production

Growth in production of urad was highest in Moradabad district (22.11 per cent/annum), followed by the districts of Rampur (21.64), J.P.Nagar (16.05), Bareilly (15.43), Budaun (14.93), Lalitpur (12.38) and Unnao (11.97), whereas high growth in between 3.94 and 11.68 per cent/annum during this period was achieved by 10 districts and medium growth (-3.80 to 3.94 per cent/annum) was seen in 34 districts. There were 16 districts which attained low negative growth of -11.54 to -3.80 per cent/annum, and the districts namely, Deoria (-14.48), Gorakhpur (-15.35) and S.K.Nagar (-21.74) recorded very low negative growth.

Yield

Yield of urad was highest in Unnao district (5.55 per cent/annum), followed by Bareilly (5.55) and J.P.Nagar (5.48) during this period. There were 21, 22 and 19 districts which recorded high, medium and low negative growth between 2.40 to 4.86, -0.06 to 2.40, and -2.52 to -0.06 per cent/annum respectively. Very low negative growth was achieved by 5 districts namely, Siddharthnagar (-2.56), S.K.Nagar (-2.98), Jhansi (-4.59), Mahoba (-4.66) and Hamirpur (-4.93).

ii. Lentil (masoor)

Area

Masoor recorded a positive growth rates in area, (0.54 per cent), production (1.45 per cent) and yield (0.90) per cent during 1995-96 to 2009-10, respectively. In
terms of area under *masoor* crop, very high growth was recorded by the districts of Kushinagar, Kanpur Nagar and Kaushambi, with 42.48, 35.59 and 21.64 per cent, respectively. High growth in between 5.47 and 15.34 per cent/annum was seen in 8 districts namely, Fatehpur, Chitrakoot, Rae Bareli, Lucknow, Allahabad, Unnao, Etah and Pratapgarh. Medium growth (-4.41 to 5.47 per cent/annum) and low growth (-14.28 to -4.41 per cent/annum) were visible in 38 and 18 districts, respectively. The districts which recorded very low negative growth (below -14.28 per cent/annum) were namely, J.P.Nagar (-15.25), Mathura (-16.36) and Varanasi (-18.04).

**Production**

The districts namely, Kushinagar, Kanpur Nagar and Kaushambi with 38.71, 37.45 and 22.89 per cent/annum also recorded very high growth in production of *masoor* crop during 1995-96 to 2009-10. There were 16, 31 and 17 districts, which were characterized with high, medium and low growth/annum during this period. Very low negative growth/annum was seen in the districts of Mathura, Varanasi and J.P.Nagar with -15.34, -15.63 and -15.88 per cent, respectively.

**Yield**

Very high growth during 1995-96 to 2009-10 in yield of *masoor* was seen in the districts namely, Kushinagar (7.72 per cent), Kanpur Dehat (3.92), Balrampur (3.76) and Budaun (3.71). There were 12 districts which achieved high growth between 1.68 and 3.63 per cent/annum during this period. Medium and low growths were recorded by 35 and 15 districts, respectively. The districts namely, Mahoba, Chitrakoot, Muzaffarnagar and Saharanpur showed a very low negative growth in yield of *masoor* to the tune of -3.02, -3.88, -4.14 and -4.14 per cent, respectively.

**iii. Green gram (*moong*)**

Other pulses recorded a negative growth in per cent/annum in area, production and yield during this period. Only peas crop showed a positive growth in yield with 0.49 per cent/annum. The districts showed a very high growth in area under *moong* were namely, Kaushambi (12.33), Chitrakoot (7.45), Mahoba (7.19), Fatehpur (5.66), Unnao (5.60) and Jalaun (4.55). Very low growth per annum in area was seen in the districts of Siddharthnagar (-18.31) Sitapur (-19.38) and Balrampur (-29.43). Very high growth in production of *moong* was recorded by the districts
namely, Kaushambi (13.78), Unnao (7.90), Fatehpur (6.82), Etawah (6.20), Jalaun (5.55) and Kanpur Nagar (5.36), and the districts of Shrawasti and Mathura with 8.90 and 6.14 per cent/annum showed very high growth in yield of moong.

iv. Pigeon pea (arhar)

During 1995-96 to 2009-10, the district of Kushinagar showed highest growth of 28.59 per cent/annum in area under arhar crop, whereas very high growth in production was recorded in the districts of Kushinagar (25.13), Baghpat (7.57) and Ghaziabad (4.86). Yield of arhar crop recorded very high growth in the districts of Kushinagar (7.67), Ghaziabad (4.10) and Meerut (4.10). Very low negative growth in area was seen in the districts of Bijnor (-18.66), Bareilly (-23.82), Rampur (-25.01) and Pilibhit (-25.39). In production, Agra (-19.30), Bijnor (-20.17), Bareilly (-23.12), Pilibhit (-24.54) and Rampur (-26.39) districts and in yield, the districts of Hamirpur (-6.95), Banda (-8.40), Chitrakoot (-8.67), Fatehpur (-8.79), Allahabad (-9.02), Jhansi (-9.69) and Kaushambi (-13.22) showed very low negative growth.

v. Gram

Growth in area under gram crop was positive in the districts of Chitrakoot (6.31 per cent/annum), Kanpur Nagar (5.63), Kushinagar (2.66) and Mahoba (2.48). Rest of the districts recorded a negative growth as Aligarh (-35.86), G.B.Nagar (-31.99), Baghpat (-32.99), Bareilly (-34.32) and Siddharthnagar (-35.86) which were at the bottom of negative growth. Similarly, there were very few districts namely, Kanpur Nagar, Chitrakoot, Mahoba, Kushinagar and Fatehpur, which recorded a positive growth in production of gram during this period, whereas, during the same period, as many as 50 districts showed a positive growth in yield.

vi. Peas

Highest growth in area, production and yield of peas were recorded in the district of Kushinagar with 36.52, 37.73 and 11.63 per cent/annum, respectively during this period, whereas the district of Etah showed a lowest negative growth in respect of area, production and yield of peas crop with -40.58, -42.20 and -5.86 per cent/annum, respectively during the same period of time.

c. Trends of growth in area, production and yield under oilseed crops

Area
In the year 1995-96, about 1.08 million ha. area was under oilseed crops in the state, which decreased to 0.95 million ha. in 2009-10, with a negative growth rate of -1.15 per cent/annum. Only 24 districts showed a positive growth in area during this period and the remaining districts recorded negative growth (Table 5.18 and Fig. 5.9). During this period, very high growth was observed in 4 districts namely, Jalaun (6.73), Kaushambi (6.21), Hamirpur (5.60) and Jhansi (5.15). High and medium growths were recorded in 19 and 22 districts whereas, 20 districts showed low negative growth per annum. Very low negative growth per annum (below -7.06 per cent) was registered in the districts namely, Allahabad, Farrukhabad, Shravasti, G.B.Nagar and Hathras.

**Production**

Production of oilseeds in the state was also characterized with a negative growth rate (-1.09 per cent/annum) during the period of 1995-96 to 2009-10. Out of a total of 70, 39 districts registered positive growth. Very high growth was found in the districts of Kaushambi (7.99 per cent), Ambedkar Nagar (7.69), Azamgarh (7.44) and Budaun (6.46). High growth characterized with values ranging between 1.74 and 5.59 per cent/annum was recorded in 19 districts, and medium growth of -2.12 to 1.74 per cent/annum was recorded in 25 districts. Low negative (-5.97 to -2.12 per cent/annum) and very low negative (less than -5.97 per cent/annum) growths were seen in 15 and 7 districts, respectively.

**Yield**

As shown in Table 5.18, yield of oilseeds registered a positive growth rate of 0.06 per cent/annum in the state. As many as 56 districts characterized with positive growth. Very high growth was seen in Ghazipur district (6.85 per cent/annum). High growth between 2.74 and 5.45 per cent was recorded in 18 districts, and 37 districts were having medium growth of 0.04 to 2.74 per cent/annum. Low and very low growth rates in yield of oilseed crops were recorded in 8 and 6 districts, respectively. These were 14 districts to show a negative growth, which were namely, Kanpur Nagar (-0.17), Bareilly (-0.17), Saharanpur (-0.18), Rae Bareli (-0.29), Lalitpur (-0.33), Fatehpur (-0.45), Hardoi (-0.72) Maharajganj (-0.79), Banda (-2.77), Hamirpur (-4.38), Jalaun (-4.74), Chitrakoot (-5.67), Mahoba (-7.77) and Jhansi (-8.52), respectively.
### Growth Rate Per Annum in Area, Production and Yield of Oilseed Crops in Uttar Pradesh: 1995-96 to 2009-10

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (per cent)</th>
<th>No.</th>
<th>Name of District</th>
<th>Range (per cent)</th>
<th>No.</th>
<th>Name of District</th>
<th>Range (per cent)</th>
<th>No.</th>
<th>Name of District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Above 4.01</td>
<td>4</td>
<td>Jhansi, Kanpur, Hamirpur and Jaunpur</td>
<td>Above 5.59</td>
<td>4</td>
<td>Kanpur, Ambedkar Nagar, Azamganj and Badaun</td>
<td>Above 5.43</td>
<td>1</td>
<td>Ghazipur</td>
</tr>
<tr>
<td>High</td>
<td>0.32 to 4.01</td>
<td>19</td>
<td>Ambedkar, Ambadhar Nagar, J.P. Nagar, Lakhimpur, Mahoba, Budaun, Kanpur Nagar, Baghpat, Jhansi, Filahi, Churaha, Munafgarh, Firozpur, Budaun, Banda, Lakhimpur, Banda, Meraur, Gosaigaon</td>
<td>1.74 to 5.59</td>
<td>19</td>
<td>Varanasi, Jhansi, J.P. Nagar, Filahi, Ballia, Budaunpur, Mathura, Baghpat, Munafgarh, Azamganj, Sitapur, Firozpur, Banda, Banda, Budaun, Lakhimpur, Ghazipur, Kanpur Nagar, Moradabad and Mau</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>-3.37 to 0.32</td>
<td>22</td>
<td>Kanpur, Unnao, Faizabad, Sultanpur, Sitapur, Varanasi, Pratapgarh, Deoria, Azamgarh, Mira-Bhayang, Moradabad, S.K. Nagar, Khair, Rae Bareli, Lucknow, Budaun, Gorakhpur, Churaha, Chindwadi, Gonda and Bijawar</td>
<td>-2.12 to 1.74</td>
<td>25</td>
<td>Varanasi, Allahabad, Elahabad, Mau, Gonda and Budaun, Budaunpur, Firozpur, Lucknow, Unnao, Pratapgarh, S.K. Nagar, Gorakhpur, Deoria, Bijawar, Budaun, Chindwadi, Gonda, and Budaun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>-7.06 to -3.27</td>
<td>26</td>
<td>Unnao, Mau, Kanpur, Mau, Mau, Mathura, Basti, Shahdargarh, Budaunpur, Torah, Agaon, Banda, Hardoi, Ghazipur, Deoria, Sidharthanagar, Kanpur Dehat, Mau, S.K. Nagar, Aligarh, Firozpur, Saharanpur and Hamirpur</td>
<td>-5.87 to -2.12</td>
<td>15</td>
<td>Allahabad, Sidharthanagar, S.K. Nagar, Shahdargarh, Kanpur Dehat, Budaunpur, Allahabad, Aligarh, Mathura, Budaun, Mau, Hardoi, Shahdargarh, and Budaunpur</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Low</td>
<td>Below -7.06</td>
<td>5</td>
<td>Allahabad, Farrukhabad, Siwan, G.B. Nagar and Hathras</td>
<td>Below -5.97</td>
<td>7</td>
<td>Farrukhabad, Saharanpur, Banda, Siwan, Allahabad, Hathras and G.B. Nagar</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Office of Agricultural Statistics (various issues), Department of Agriculture, Lucknow.
UTTAR PRADESH
Growth in Area, Production and Yield of Oilseed Crops
1995-96 to 2009-10

Fig. 5.9

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i. Sesamum (*til*)

**Area**

Among oilseeds, *til* recorded positive growth rate of 7.24, 7.71 and 0.44 per cent/annum in area, production and yield during this period, respectively. There were 3 districts namely, Auraiya (46.96), Jhansi (26.70) and Jalaun (16.34) which recorded very high growth in area. High growth between 5.06 and 14.67 per cent/annum was seen in 13 districts whereas, medium growth of -4.54 to 5.06 per cent/annum was recorded by 36 districts. Low negative growth between -14.15 and -4.54 per cent/annum was achieved by 15 districts during this period. The districts namely, Faizabad (-15.14), Ambedkar Nagar (-16.38) and Bijnor (-17.43) showed very low negative growth.

**Production**

Growth in production of *til* is seen very high in the districts of Auraiya (43.96 per cent), Jhansi (23.35), Jalaun (22.03) and Unnao (14.68). Having high growth between 5.06 and 14.49 per cent/annum, there were 13 districts included within this range, whereas medium (-4.37 to 5.06 per cent/annum) and low (-13.80 to -4.37 per cent/annum) growths were visible in 28 and 23 districts, respectively. The districts of Bijnor and Bulandshahr were characterized with very low negative growth of -14.16 and -15.38 per cent/annum, respectively.

**Yield**

During the period of 1995-96 to 2009-10, very high growth in yield of *til* was recorded in the districts namely, Bahraich (6.81 per cent/annum), Banda (6.52), Unnao (5.98), Jalaun (4.89) and Hardoi (4.68). High, medium and low negative growths were seen in 14, 25 and 24 districts, whereas the districts of Ambedkar Nagar and Hathras attained very low negative growth to the tune of -5.10 and -5.27 per cent, respectively during this period.

ii. Mustard and rapeseed

**Area**

Mustard and rapeseed are the most important oilseed crops grown in the state. With respect to them, the state showed a negative growth both in area and production with -2.25 and -0.37 per cent/annum, respectively. Very high growth in area of
mustard and rapeseed was seen in the districts of Lalitpur (15.64), Bijnor (6.23) and Azamgarh (5.28). There were 17 districts which belonged to the next category of high growth (0.76-4.67 per cent/annum). Medium growth in between -3.15 and 0.76 per cent/annum was seen in 29 districts. Low negative growth was occupied by 17 districts, and the districts namely, Farrukhabad (-8.25), G.B.Nagar (-8.80), Hathras (-8.87) and Shrawasti (-9.02) were characterized with very low negative growth during this period.

Production

Very high growth in production of mustard and rapeseed was attained by the districts of Lalitpur (17.89 per cent/annum), Bijnor (8.66), Azamgarh (8.17) and Ambedkar Nagar (7.91). High growth between 3.16 and 7.51 per cent/annum, and medium between -1.20 and 3.16 per cent/annum was attained by 17 and 27 districts, respectively. There were 16 districts within the category of low negative growth (-5.56 to -1.20 per cent/annum). The districts namely, Chitrakoot (-5.85), Rampur (-5.86), Farrukhabad (-5.97), Shrawasti (-6.87), Hathras (-7.51) and G.B.Nagar (-8.06) experienced very low negative growth.

Yield

Growth in yield of mustard and rapeseed was positive (1.92 per cent/annum) in the state during this period. Out of 70, 65 districts have shown a positive growth. Very high growth in yield of these crops was recorded in Varanasi (7.90), Ghazipur (7.89) and Mathura (5.20) districts. Very, low negative growth during this period was recorded by the districts namely, Mahoba (-0.98), Maharajganj (-1.42), Banda (-1.46) and Chitrakoot (-4.24). High, medium and low growths were seen in 13, 35 and 15 districts, respectively.

d. Trends of growth in area, production and yield under cash crops

Area

Table 5.19 shows that area under cash crops in the state during 1995-96 to 2009-10 recorded a growth rate of 0.72 per cent/annum. A total of 31 districts attained a positive growth and negative growths were recorded in remaining of 39 districts. Very high growth was seen in 6 districts namely, Hathras (13.22 per cent), Birlampur (12.99), Agra (12.20), Kanpur Nagar (10.31), Gonda (9.95) and Firozabad (8.72). High growth between 2.34 and 6.73 per cent/annum was recorded in the
districts namely, Mahoba, Aligarh, Shrawasti, Sitapur, Kannauj, Etawah, Hardoi, Bahraich and Mainpuri. As many as 31 districts achieved medium growth (-2.04 to 2.34 per cent/annum) and low negative growth (-6.43 to -2.04 per cent/annum) was seen in 22 districts. The districts of Pratapgarh (-6.48 per cent) and Kanpur Dehat (-6.77 per cent) recorded a very low negative growth per annum during this period (Fig. 5.10).

Production

During 1995-96, the production of cash crops has been 128.84 million tonnes which increased to 131.45 million tonnes during 2009-10 with a negative growth rate of -0.31 per cent/annum. Total of 25 districts recorded a positive growth and rest of the districts were characterized with negative growth. There were 7 districts namely, Hathras (13.09 per cent), Balrampur (12.46), Gonda (10.21), Kanpur Nagar (9.41), Agra (9.40), Firozabad (9.09) and Shrawasti (6.43) showing very high growth per annum. High growth between 1.91 and 6.33 per cent/annum was seen in 8 districts namely, Mahoba, Bahraich, Hardoi, Sitapur, Kannauj, Baghapat, Kheri and Mainpuri. There were 30 districts, which were characterized with moderate growth of -2.50 to 1.91 per cent/annum, whereas the remaining 25 districts attained a low negative growth in between -6.92 and -2.50 per cent/annum.

Yield

During 1995-96, the average yield of cash crops was 543.1 quintals per hectare, which declined to 522.18 quintals per hectare during 2009-10 and attained a negative growth rate of -0.41 per cent/annum. Very high growth in cash crops during this period was seen in the districts namely, Shrawasti (2.44 per cent), S.R.Nagar (1.74) and Lucknow (1.32). High growth between 0.09 and 1.14 per cent/annum was seen in 16 districts. A total of 32 districts were having medium growth ranging from -0.97 to 0.09 per cent/annum. Low negative growth (-2.02 to -0.97 per cent/annum) was observed in 14 districts, and 5 districts namely, Allahabad (-2.06), Agra (-2.50), Aligarh (-2.88), Jalaun (-3.28) and Mathura (-3.33) had very low negative growth during this period.

1. Sugarcane

Area

During the 1995-96, area under sugarcane was 1.99 million ha. which
<table>
<thead>
<tr>
<th>Category</th>
<th>Range (per cent)</th>
<th>No.</th>
<th>Area Name of district</th>
<th>Production Range (per cent)</th>
<th>No.</th>
<th>Production Name of district</th>
<th>Yield Range (per cent)</th>
<th>No.</th>
<th>Yield Name of district</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Above 6.73</td>
<td>6</td>
<td>Hathras, Bahraich, Agra, Kanpur, Nager, Gonda and Faizabad</td>
<td>Above 6.33</td>
<td>7</td>
<td>Hathras, Bahraich, Deoria, Kanpur, Nager, Agra, Faizabad and Shahjahanpur</td>
<td>Above 1.14</td>
<td>3</td>
<td>Sarnath, S.Nagar and Lucknow</td>
</tr>
<tr>
<td>High</td>
<td>2.34 to 6.73</td>
<td>9</td>
<td>Mahoba, Aligarh, Sawai, Bina, Gorakhpur, Haldwani, Shahjahanpur and Mirzapur</td>
<td>1.91 to 6.33</td>
<td>3</td>
<td>Mahoba, Bahraich, Hardoi, Sitapur, Kannauj, Baghpat, Khai and Mainpur</td>
<td>0.09 to 1.14</td>
<td>16</td>
<td>Pratapgarh, Bahraich, Muzafarpur, Baghpat, Hardoi, Sihkondhar, G.B.Nagar, Faizabad, Umar, Ghazipur, Khair, Faizabad, Meerut, Gorakhpur and Mehnagar</td>
</tr>
<tr>
<td>Medium</td>
<td>-2.04 to 2.34</td>
<td>31</td>
<td>Bulandshahr, Buda, Kheri, Baghpat, Saharanpur, Pilibhit, Jhansi, Muzaffarnagar, Faizabad, Amroha, Galmiabad, Bijnor, Jhansi, Moradabad, Bareilly, Panipat, Dehri, Saharanpur, Ambedkar Nagar, Banda, J.P.Nagar, Mahajgarh, Kushinagar, Sambalpur, Buxar, Ratu, Buda, Maujpur, Maujpur, Bareilly, S.K.Nagar and Kansalsari</td>
<td>-2.50 to 1.91</td>
<td>10</td>
<td>Bulandshahr, Aligarh, Saharanpur, Pilibhit, Jhansi, Muzaffarnagar, Amroha, Umar, Bijapur, Sitapur, Gorakhpur, Ambadkar Nagar, Mahajgarh, Jhansi, Bara, Bareilly, Buda, J.P.Nagar, Mahajgarh, Kushinagar, Sambalpur, Bareilly, Faizabad, Lucknow, S.K.Nagar, Parthipur, Bareilly and Jampur</td>
<td>-0.97 to 0.95</td>
<td>32</td>
<td>Sambhal, Kanpur Dehat, Saharanpur, Sitapur, Kushinagar, Amroha, Muzaffarnagar, Hastin, Barei, Maujpur, J.P.Nagar, Kanpur, Ratu, J.P.Nagar, Buda, Varanasi, Bulandshahr, Pilibhit, Dehri, J.P.Nagar, Sambalpur, Chhindwara, Buda, Bareilly, Bulandshahr, Kanpur, Nager, Deoria, Moradabad and Bareilly</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -6.43</td>
<td>2</td>
<td>Pratapgarh and Kanpur Dehat</td>
<td>Below -6.92</td>
<td>0</td>
<td></td>
<td>Below -3.02</td>
<td>5</td>
<td>Allahabad, Agra, Aligarh, Jhansi and Meerut</td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various years). Directorate of Agriculture, Lucknow.
Growth in Area, Production and Yield of Cash Crops
1995-96 to 2009-10

Fig. 5.10

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registered a slight increase of 2.0 million ha. with a growth rate of 0.46 per cent/annum. Growth in production of sugarcane was 0.11 per cent/annum. Contrary to it, during this period, yield recorded a negative growth of -0.34 per cent/annum. Very high growth in area of sugarcane was noticed in the districts of Balrampur (14.24), Gonda (11.74), Shrawasti (8.79), Mahoba (6.44) and Kanpur Nagar (6.38). High growth was seen in 14 districts, and 30 districts in the state recorded medium growth in between -4.73 and 0.37 per cent/annum. There were 18 districts to show low growth of -9.82 to -4.73 per cent/annum, whereas very low growth was recorded in the districts namely, Agra (-11.55), Allahabad (-11.84) and Etawah (-12.76).

Production

As regards the growth in production of sugarcane, again the districts of Balrampur (12.81 per cent/annum), Gonda (10.72) and Shrawasti (8.25) recorded very high growth during this period. Very low negative growth was seen in the districts of Allahabad (-11.97), Agra (-12.14), Etawah (-13.05) and Jhansi (-17.17).

Yield

Very high growth per annum in yield of sugarcane was noticed in the districts of Kaushambi (3.55 per cent), S.R.Nagar (3.13) and Unnao (1.92), whereas the districts namely, Lalitpur (-3.73), Jalaun (-3.73) and Jhansi (-9.99) were included in the category of districts showing very low growth per annum. High, medium and low growth rates were seen in 12, 46 and 6 districts, respectively.

ii. Potatoes

Area

Growth rates in area, production and yield of potatoes in the state were in order of 1.95, 2.97 and 1.01 per cent/annum, respectively. Very high growth in area under potato crop was recorded in the districts namely, Hathras (13.64), Agra (12.77), Kanpur Nagar (12.10), Aligarh (10.56) and Firozabad (8.84). High and medium growth rates of 1.78 to 6.64 and -3.08 to 1.78 per cent/annum were recorded by 11 and 36 districts, respectively. Low growth (-7.94 to -3.08 per cent/annum) was seen in 16 districts, and the districts of Shrawasti (-10.41) and Pratapgarh (-16.57) were characterized with very low negative growth.
Production

Growth in production of potato was seen highest in the district of Hathras with 14.10 per cent/annum, followed by the districts of Kanpur Nagar (13.53), Aligarh (10.75), Agra (10.36) and Firozabad (9.33). There were 12 districts which attained high growth in between 3.03 and 8.13 per cent/annum. Medium growth of -2.07 and 3.03 per cent/annum was recorded by 35 districts, and low negative growth (-7.17 to -2.07 per cent/annum) in production of potatoes was seen in 14 districts. The districts namely, Baghpat with -7.12 per cent/annum, Shrawasti (-7.20), G.B.Nagar (-8.78) and Pratapgarh (-20.05) were characterized with very low negative growth during this period.

Yield

Very high growth in yield of potatoes was recorded in the districts of Siddharthnagar (6.18 per cent/annum), Basti (6.18), S.K.Nagar (6.15), Gorakhpur (4.90), Deoria (4.84) and Maharajganj (4.74). High growth in between 2.23 and 4.50 per cent/annum was seen in 12 districts, and medium growth (-0.05 to 2.23 per cent/annum) was attained by 36 districts. Low negative growth (-2.32 to -0.05 per cent/annum) was noticed in 13 districts, and the districts namely, Kaushambi (-2.95), Barabanki (-2.97) and Pratapgarh (-8.03) recorded very low negative growth.

D. Crop-Combination Regions

Generally, crops are grown in association with other crops. It is a rare phenomenon that a single crop occupies the position in complete isolation in an agricultural landscape. Ranking of crops and their spatial distribution bring out the regional dominance of crops at a glance (Bhatia, 1965). The areal strength of crops grown determines the cropping pattern and spatial variations in crops cultivated present an overview of agricultural landscape in any region. With the delineation of crop-combination regions, agricultural planning can be suggested for better performance of farming. In order to increase productivity and to save soils from fertility depletion, careful and judicious utilization of land by selecting an appropriate crop combination is essential. It is therefore, advisable to identify, for each agricultural set-up, a crop-combination which would give optimum agricultural returns and provide employment to farmers and their dependents. By paying more attention to the major constituent crops in a region, farmers can increase the
production of food and raw materials. While doing so, less important crops can be excluded from the combination and land can be put to other remunerative crops which perform well with less input (Thakur, 2007).

New agricultural technology incorporated within the frame of green revolution in India during 1960's had played a very important role in changing the cropping pattern and increasing productivity of land. The trio of green revolution—high yielding varieties of seeds (HYVs), irrigation water and chemical fertilizers has played an important role. Moreover, substantial emphasis was given to increase the quantum of irrigation water through surface and underground sources, and bring more areas under irrigation. Consequently, the cropping pattern has completely changed with the adoption of new farming technologies. Farmers are now in a position to grow more remunerative crops with bringing a change in cropping pattern.

As a result of the diffusion of high-yielding varieties of rice and wheat in many parts of the country, traditional subsistence agriculture has been transformed into a market oriented economy. Now in most of the agro-climatic regions, the farmers are concentrating their choice on a few crops with the intention of increasing income from agriculture. The strength of monoculture has increased in the post-green revolution period, while the increase in two-and-three-crop combination has also recorded. Thus, after the adoption of high-yielding varieties of rice and wheat the farmers are increasingly concentrating on a smaller number of crops. On the other hand, there has been a significant decrease in the number of areal units with multi crop combinations. This proves that, Indian farming is moving towards a market oriented economy (Husain, 1989).

This section of the thesis attempts to delineate the crop-combination regions determined for the period of 1995-2000, 2000-05 and 2005-10. It has further been attempted to put the individual crop on ranks to demarcate area acquired by a particular crop in order to put these crops as first, second and third rankings. The crop-combination regions delineated for 70 districts of the state were based on Doi's method for determining the crop-combinations.

To delineate crop-combination regions in the districts of Uttar Pradesh, the entire exercise of crop-combination has been based on applying the Doi's method instead of Weaver's method. Doi's method incorporates a slight improvement in respect of computation of values in the combination analysis. His method substitutes the variance ($\sum d^2/n$) or least standard deviation) as it is contained in Weaver's
method, with the sum of square deviations ($\Sigma d^2$). The computed value of individual crop concentration characterized with lowest $\Sigma d^2$ will form the combination in the analysis. Doi’s *One Sheet Table* of critical values which he has provided in the study was used. Use of the table requires only the summing up of actual percentages of area for the crop, which are considered instead of finding the differences between actual percentages and theoretical distribution, and then consult the table for the critical value of next element at that accumulated percentage level. If the critical value is higher than that of the actual percentage of crop area, the crop is not considered, but if otherwise the value is lower than the crop percentage, crop will be included in the combination.

Pioneering work for determining crop-combination was initiated by Weaver (1954) in his study of Middle West of U.S.A. Since then this method was adopted to delineate crop-combination regions in a number of studies pertaining to developed and developing countries of the world. Some attempts were also made to modify the Weaver’s method on the pretext to remove the inherent weakness of the method.

One of the early attempts was made to determine crop association regions by Johnson (1958) in East Pakistan considering 3 major crops of wheat, barley and maize, 3 oilseed crops, 6 pulse crops and 8 other field crops, and in addition 6 ‘orchard’ crops were also considered. For the determination of crop-association regions, a five-fold scale of relative importance was calculated for each crop, using mean point in the scale as the percentage of total cultivated land occupied by the crop in East Pakistan as a whole. Intensity of cultivation was calculated to show the degree of correspondence between cropping intensity and crop-association in the region. Rafiullah (1965) examined the functional classification of towns in the districts of Bulandshahar, Meerut, Muzaffarnagar and Saharanpur of upper Ganga-Yamuna *doab* of Uttar Pradesh. He evolved a new formula by modifying the Weaver’s minimum deviation method for the determination of primary functional combinations in selected towns of upper Ganga-Yamuna *doab*.

Singh (1965) studied the crop-combination regions in the Malwa tract of Punjab using Weaver’s method of crop-combination regions. He added two modifications in Weaver’s method by selecting two sequential regions: Region I and Region II for 4 crops: wheat, wheat-gram, gram and cotton. He delineated 22 crop-combinations which were grouped into 9 units belonging to second order regions. Ahmad and Siddiqi (1967) attempted to analyse the crop-association patterns in Luni


All of the 18 major crops grown in the districts of the state were considered and grouped as: cereal crops (wheat, rice, maize, bajra, barley, and jowar), pulse crops (urad, moong, arhar, gram, peas, and masoor), oilseed crops (groundnut, soyabean, til, mustard and rapeseed) and cash crops (sugarcane and potatoes) were considered in the entire exercise for the determination of crop-combinations. Out of total 18 crops, 16 crops formed combinations (moong and soyabean were excluded
from the analysis because of as these crops constituted a negligible area in cultivation). The crops considered were further grouped into 10 different categories (Table 5.20).

a. Crop Rankings

i. First ranking crops

From Table 5.20 and Fig. 5.11, it is evident that, during the period of 1995-2000 only three crops (wheat, rice and sugarcane) emerged as the first ranking crops in different districts of the state. Wheat acquired a significant area in 54 districts; rice occupied a prominent position in 12 districts. Sugarcane appeared as third crop to a predominant position in 4 districts. Number of crops increased to 4 in this category during the period of 2000-05. Fourth crop of gram was added to become the first ranking crop. Wheat again was dominant crop in 50 districts, rice and sugarcane occupied important positions in 12 and 6 districts, respectively. Cultivation of gram was confined to only 2 districts of the state (Fig. 5.12). During 2005-10, wheat again occupied a dominant position in 53 districts to emerge as a first ranking crop. During this period, rice and sugarcane covered the largest area in 10 and 6 districts, respectively and gram was dominant in cultivation in Mahoba district (Fig. 5.13).

Table 5.20 Ranking of crops and number of districts in Uttar Pradesh

<table>
<thead>
<tr>
<th>Crop</th>
<th>1st rank</th>
<th>2nd rank</th>
<th>3rd rank</th>
<th>1st rank</th>
<th>2nd rank</th>
<th>3rd rank</th>
<th>1st rank</th>
<th>2nd rank</th>
<th>3rd rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>54</td>
<td>30</td>
<td>53</td>
<td>16</td>
<td>20</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>34</td>
<td>33</td>
<td>36</td>
<td>9</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Millets</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Barley</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Millets</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Gram</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>9</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Other pulses$^4$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Oilseeds$^5$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>19</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Potato</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

A change that was seen during the periods of 1995-2000 and 2000-05 has been that, in the districts of Saharanpur and Khuri, sugarcane was replaced with

$^4$ Millets include jowar and bajra
$^5$ Other pulses include urad, peas, masoor and arhar
$^6$ Oilseeds include mustard and rapeseed, groundnut and til
Fig. 5.11

UTTAR PRADESH
First Ranking Crops
1995-2000

Index
- Wheat
- Rice
- Sugarcane

Fig. 5.11
Fig. 5.13
that of wheat whereas, in the districts of Bahraich, Gonda, Shravasti and Balrampur and of eastern U.P., rice replaced the wheat, and in the districts of Hamirpur and Mahoba, gram replaced the wheat. In contrast to this, in 3 districts namely, Pilibhit, Ambedkar Nagar and Faizabad, rice crop was replaced by wheat. During the period of 2005-10, a change in crop ranking of 2000-05 period has been observed in 4 districts namely, Pilibhit, Hamirpur, Rampur and Basti, among them rice replaced wheat in Pilibhit district whereas, in other 3 districts wheat emerged as a dominant crop by replacing gram and rice, respectively (Fig 5.13).

**ii. Second ranking crops**

During the period of 1995-2000, among second ranking crops, 8 crops namely, sugarcane, wheat, maize, rice, bajra, mustard and rapeseed, peas and gram acquired an important area in the state. Rice cultivation was important in 34 districts. Wheat occupied an important area in 16 districts. Out of 5 districts, 4 belonged to middle doab and the district of Budaun formed part of Rohilkhand plains, where bajra has been the dominant crop. Gram occupied a prominent position in 5 districts whereas, maize cultivation was important in 3 districts. In 2 districts other pulse crops dominate, and in 2 districts mustard and rapeseeds were dominant. Sugarcane cultivation was seen important in 3 districts (Fig.5.14).

During the period of 2000-05, mustard and rapeseeds were excluded from this category. Rice was dominant in cultivation as compared to other crops, which covered an important area in 33 districts. Next in importance was wheat, which was seen dominant in 20 districts. Bajra, maize, gram, other pulses and sugarcane were important in cultivation in 7, 3, 4, 1 and 2 districts of the state, respectively.

During the period of 1995-2000 to 2000-05, a change was observed in second ranking crops. In 3 districts namely, Pilibhit, Ambedkar Nagar and Faizabad, wheat was replaced by rice crop in cultivation. Contrary to this, in 4 districts rice was replaced by wheat. In the districts of Hamirpur and Mahoba, wheat replaced gram. In Saharanpur, sugarcane was replaced by wheat, and in the district of Agra, the cultivation of bajra replaced the mustard and rapeseed crops. Further, in the districts of Jalaun and Jhansi, gram cultivation replaced peas, and in Lalitpur, the cultivation of gram was replaced by urad (Fig.5.15).

During the period of 2005-10, in second ranking category, rice achieved a dominant place in 36 districts instead of 33 districts in the previous period. Wheat
UTTAR PRADESH
Second Ranking Crops
1995-2000

Fig. 5.14

258
Fig. 5.15

UTTAR PRADESH
Second Ranking Crops
2000-05

Index
- Wheat
- Rice
- Maize
- Bajra
- Gram
- Other Pulses
- Sugarcane

20 40 60 80 100
Km
Fig. 5.16
occupied an important place in 17 districts as compared to 20 during 2000-05. *Bajra* was dominated in 6 districts. Gram occupied a significant place in 3 districts and maize, sugarcane and other pulses occupied a significant place in 2, 2 and 2 districts, respectively (Fig. 5.16).

During the period of 2000-05 to 2005-10, 9 districts experienced a change in second ranking crops. In 4 districts namely, Bulandshahr, Rampur, Sonbhadra and Basti, rice replaced maize and wheat crops, respectively. In the district of Pilibhit, wheat was recognised as second crop replacing rice crop. In the districts of Mathura, Jhansi, Jalaun and Hamirpur, the crops namely, mustard and rapeseed, *til*, peas and gram replaced *bajra*, gram and wheat, respectively.

**iii. Third ranking crops**

As third ranking crops, there were 13 crops recognized as dominant in the state. Among 19 districts, sugarcane was the dominant crop. Next to sugarcane was maize occupied an important position in 10 districts. Cultivation of rice was dominant in 9 districts. Among cereals, barley was seen in single district of Sonbhadra. Out of 18 districts, in 9 districts, gram was a dominant crop and in rest of 9 districts other pulses dominated. Next in importance were millets which dominated in 8 districts as the third ranking crops: Oilseeds dominated in 3 districts and in 2 districts potatoes have been third ranking crop (Fig. 5.17).

During the period of 2000-05, one crop of barley was excluded from this category. Sugarcane was the dominant crop which acquired an important position in 18 districts. Cultivation of maize was important in 12 districts. Rice cultivation dominated in 9 districts, and millets, gram, other pulses, oilseeds and potatoes acquired a significant area in 7, 5, 12, 3 and 4 districts, respectively (Table 5.20).

During 1995-2000 to 2000-05, in the districts of Kanpur Nagar, Allahabad, Jhansi, Jalaun, Siddharthnagar and Sultanpur, the cultivation of gram was replaced by maize, *bajra*, *urad*, peas, mustard and rapeseed and peas, respectively. Further, in the districts of S.K. Nagar, Kheri and Barabanki, sugarcane was replaced by peas, rice and *masoor* crops, respectively. In the districts of Mathura and Agra, *bajra* was replaced by mustard, and in Hathras and Firozabad districts, mustard and rapeseed were replaced by potatoes. In Lalitpur district, gram replaced *urad*; barley was replaced by maize crop in Sonbhadra district. The cultivation of *masoor* was replaced by sugarcane in Balrampur district (Figs. 5.18 and 5.19). During the period of 2005-10,
UTTAR PRADESH
Third Ranking Crops
1995-2000

Index
- Rice
- Maize
- Barley
- Bajra
- Gram
- Other Pulses
- Oilseeds
- Sugarcane
- Potato

Fig. 5.17
UTTAR PRADESH
Third Ranking Crops
2005-10

Index

- Rice
- Maize
- Bajra
- Gram
- Other Pulses
- Oilseeds
- Sugarcane
- Potato

Fig. 5.19

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sugarcane was a dominant crop to cover a significant area in 18 districts of the state. Next to sugarcane, other pulses, rice, maize and millets (bajra) were significant in 12, 11, 10 and 9 districts, respectively. Gram was dominant in 4 districts, and potatoes and oilseeds were important crops in 4 and 2 districts, respectively.

During the period of 2000-05 to 2005-10, a prominent change was noticed in the state. In the districts of Mathura, Varanasi and Ghazipur, bajra replaced mustard and rapeseed, sugarcane and masoor, respectively whereas, in S.K.Nagar, Sultanpur and Gonda districts, sugarcane replaced peas and maize crops, respectively. Masoor replaced jowar, mustard and rapeseed, and maize crop in the districts of Chitrakoot, Siddharthnagar and Shrawasti, respectively. Whereas, in Bulandshahr, Aligarh, Lalitpur, Jalaun and Mahoba districts, crops of sugarcane, maize, gram and peas were replaced by maize, rice, peas, til and urad crops, respectively.

b. Crop-Combination Regions

Crop-combination regions based on Doi’s method were delineated for the periods of 1995-2000, 2000-05 and 2005-10 as shown in Figs. 5.20, 5.21 and 5.22. Crop-combination regions in the districts of the state were ranged in numbers from 1 to 6 crops. Combination regions identified were as follows:

i. Single crop-combination/monoculture

During 1995-2000, the districts of Muzaffarnagar and G.B.Nagar from upper doab, and Bijnor belonging to Rohilkhand plains characterized with a single crop-combination. In the districts of Muzaffarnagar and Bijnor, sugarcane was identified as the dominant crop, and in G.B. Nagar district wheat occupied the dominant position. During the period of 2000-05, a single crop-combination was visible in 8 districts as 5 new districts namely, Meerut, Baghpat, Mathura, Lucknow and Unnao were added in this category (Figs.5.20 and 5.21). A change was noticed in the percentage of area under sugarcane in Meerut and Baghpat districts, whereas, an increase area was seen in wheat cultivation in the districts of Mathura, Lucknow and Unnao. During 2005-10, two new districts namely, S.R.Nagar and Gorakhpur in the category, where wheat is a dominant crop, thereby, there has been an increase in number of districts from 8 to 10 in monoculture combination (Fig. 5.22).

ii. Two crop-combinations

Two crop-combinations were dominated in 31 districts of the state during
Table 5.21 Crop-combination regions in Uttar Pradesh

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Name of district</td>
<td>No.</td>
</tr>
<tr>
<td>One Crop-combination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two Crop-combination</td>
<td>31</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four Crop-combination</td>
<td>11</td>
<td>Alligarg, Bijnor, Kanpur Nagar, Aurlaya, Bahraich and Sonhlabad</td>
<td>4</td>
</tr>
<tr>
<td>Five Crop-combination</td>
<td>3</td>
<td>Kanpur Nagar, Jhansi and Hamipur</td>
<td>5</td>
</tr>
<tr>
<td>Six Crop-combination</td>
<td>2</td>
<td>Kanpur Dehat and Lalitpur</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

1995-2000. Among these districts, 3 belonged to upper doab, one from lower doab and 4 from Rohilkhand plains. A total of 8 districts formed two crop-combinations in the Awadh plains, and the remaining 15 districts belonged to Purvanchal region of the state. In the districts of upper doab, sugarcane and wheat formed a common crop
component. In three districts of Rohilkhand plains namely, Shahjahanpur, Pilibhit and Rampur, wheat and rice were the common components, whereas, in the district of J.P.Nagar, sugarcane and wheat were the common components. The district of Allahabad of lower doab registered, wheat and rice as the common components. In all the districts belonging to Awadh and Purvanchal regions, wheat and rice remained as dominant crops during this period.

During the period of 2000-05, two crop-combinations show a slight decrease in number of districts (Table 5.21). Two more districts of Hathras and Hardoi were added in this combination, and four districts of Meerut, Baghpat, Lucknow and Unnao showed a shift from this combination to single crop-combination. Wheat and bajra were dominant in Hathras districts, whereas in Hardoi main crops were wheat and rice.

During the period of 2005-10, in this category of crop combination there remained 29 districts at the expense of a shift of three districts: Hathras district of middle doab and S.R.Nagar and Gorakhpur of Purvanchal region took a shift from this category to elsewhere to form a part of other crop-combinations, but at the same time three districts namely, Saharanpur of upper doab, Kaushambi of lower doab and Shrawasti of Awadh plains were added to this combination. In Saharanpur, sugarcane and wheat were the dominant crops, and in the districts of Kaushambi and Shrawasti, rice and wheat were two important crops to form this combination (Fig.5.22).

iii. Three crop-combinations

Three crop-combinations during 1995-2000 were seen in 20 districts of the state. The districts of Shahjahanpur and Bulandshahr of upper doab, 4 districts of middle doab, 3 of lower doab, 3 of Rohilkhand, 7 of Awadh, and a single district of Kushinagar of Purvanchal region formed this category. In Saharanpur district, wheat, sugarcane and rice were the dominant crops, and in Bulandshahr, wheat, maize and sugarcane were dominant crops in combination. The district of Farrukhabad showed wheat, maize and potatoes as the common crops in this combination, whereas, in the district of Mainpuri, wheat, rice and maize were dominant, and in Fatehpur, wheat, rice and gram formed a common component. In Awadh plains in the districts of Sitapur and Kheri, wheat, rice and sugarcane were the dominant crops, whereas, in the districts of Hardoi, Gonda, Bahraich, Shrawasti and Ballarpur, wheat and rice formed a common component. Sugarcane was replaced by maize, except in the
UTTAR PRADESH
Crop Combination Regions
1995-2000

Fig. 5.20
district of Balrampur, in which masoor was a component as third crop in the combination.

During the period of 2000-05, the number of districts having three crop-combinations increased from 20 to 23. A sum of 8 districts was added to this combination, and 5 districts were shifted to other combinations. Two districts of Aligarh and Etah of middle doab, 4 districts of Kannauj, Etawah, Auraiya and Kaushambi from lower doab, the district of Jhansi from Bundelkhand and Sonbhadra lying in eastern part of the state were added to this combination. The districts shifted from this combination were namely, Bulandshahr, Hathras and Mathura belonging to middle doab, and the districts of Hardoi and Bahraich to Awadh region.

During 2005-10, three crop-combinations were identified in 21 districts of the state. The districts namely, Saharanpur, Kaushambi, Jhansi, Sonbhadra and Shrawasti were shifted from this combination to other combinations, and the districts of Hathras, Banda and Bahraich were added to this category of three crop-combinations. In Hathras, wheat, bajra and potatoes were dominant crops, and wheat, gram and rice dominate in Banda district. The districts of Bahraich showed rice, wheat and maize as dominant crop-combination (Fig. 5.22).

iv. Four crop-combinations

During 1995-2000, there were 11 districts belonged to the category of four crop-combinations. The districts of Aligarh and Etah from middle doab, 4 districts of Kannauj, Etawah, Auraiya and Kaushambi from lower doab, Jalaun, Mahoba, Banda and Chitrakoot from Bundelkhand region, and Sonbhadra from Purvanchal region, respectively formed this category of combination. In the districts of middle doab, wheat, bajra and maize formed the common crops. In the districts of lower doab namely, Etawah, Auraiya and Kaushambi, wheat, rice and bajra were the common components, and in the district of Kaushambi, gram formed fourth component. District of Kannauj showed wheat, maize, potato and rice as components in this combination. The districts of Jalaun and Mahoba followed the same combination, except the district of Banda, in which wheat, gram, rice and jowar were the dominant crops.

In Chitrakoot district, wheat, gram, jowar and rice were dominant crops to form this combination, whereas, rice, wheat, barley and maize were the main components in Sonbhadra district.
UTTAR PRADESH
Crop Combination Regions
2000-05

Fig. 5.21
During the period of 2000-05, only 4 districts emerged having four crop-combinations they were 11 in number during the period of 1995-2000. Within this category of four crop-combinations, 3 more districts namely, Bulandshahr, Kanpur Dehat and Bahraich were added forming a part of upper doab, lower doab and from Awadh, respectively, some 10 districts viz., Aligarh, Etah, Kannauj, Etawah, Auraiya, Kaushambi, Jalaun, Mahoba, Chitrakoot and Sonbhadra took a shift from this category to another category of combinations. In Bulandshahr, wheat maize, sugarcane and rice were important crops. In Kanpur Dehat, wheat, rice, gram and mustard are dominant crops. In Bahraich, main crops in order of significance were rice, wheat, maize and masoor. It is noteworthy, that among all districts area under wheat has shown a significant increase, except the districts of Mahoba and Chitrakoot in which gram shows an increasing trend having an area of 25.79 and 26.26 per cent area under this crop (Fig.5.21).

During 2005-10, four crop-combinations were seen in 5 districts, in them the district of Kanpur Nagar was added to that of the previous period of 2000-05. The other districts having this combination were namely, Bulandshahr of upper doab, Kanpur Dehat of lower doab, and Lalitpur and Hamirpur districts of Bundelkhand region. Kanpur Nagar had wheat, rice, maize and gram as dominant crops in this combination.

v. Five crop-combinations

During 1995-2000, five crop combinations were confined to only 3 districts namely, Kanpur Nagar, Jhansi and Hamirpur. In the district of Kanpur Nagar, wheat, rice, gram, mustard and rapeseed and maize were the dominant crops, whereas, in the districts of Jhansi and Hamirpur; wheat, gram and peas were the common crops, and among other crops, groundnut and urad formed a common component in district of Jhansi, and jowar and masoor in Hamirpur district.

During the period of 2000-05, five crop-combinations were seen in 5 districts. Districts of Jalaun, Mahoba and Chitrakoot of Bundelkhand region were added to this category of combination. The district of Jhansi shifted to three crop-combination category.

During 2005-10, again in five districts this combination was visible. The districts namely, Jhansi and Sonbhadra were added to this combination, and two districts namely, Kanpur Nagar and Hamirpur formed a part of other combination
regions (Fig.5.22).

vi. Six crop-combinations

During the period of 1995-2000, six crop-combinations were confined only to two districts namely, Kanpur Dehat and Lalitpur of lower doab and Bundelkhand region, respectively. In Kanpur Dehat, wheat, rice, mustard and rapeseed, gram, maize and jowar formed this combination, and in Lalitpur, wheat, gram, urad, peas, maize and masoor were the dominant crops. During the period of 2000-05, a single district of Lalitpur was characterized with this crop-combination (Fig.5.21).

E. Cropping Intensity: A Districtwise Analysis

Cropping intensity in agriculture refers to the ratio of gross cropped area (i.e. sum of area under all the crops in a given agricultural year) to net sown area, usually expressed in percentages. It is proportion of area sown more than once (Sharma, 2000). Since time immemorial irrigation has been regarded as an essential part of sound agricultural infrastructure. It encourages farmers to adopt scientific techniques and go in for more intensive cropping thereby creating new opportunities for gainful employment. Cropping intensity is one of the main attributes of agricultural productivity because it is implicitly related to the expansion and intensification processes of agricultural land use (Singh, 1994). Intensity of cropping implies the degree of cropping or number of crops grown in the same plot during one agricultural year. It is an indication of the total cropped area as distinguished from the net sown area.

The expansion of irrigation contributes an increase in cropping intensity in the coming years. The increasing demand of food and fibre for ever increasing population is realized as one of the demographic causes of agricultural intensification. The availability of adequate irrigation facilities transforms the subsistence agriculture landscape gradually into commercial one, making agrarian economy as market oriented (Pawar and Shinde, 2007). An increase in irrigation intensity contributes to the growth in overall cropping intensity. Consequently, India has moved from the spectre of food imports and periodic famines to self-sufficiency, since the early 1970s, food exports and progressively more diversified production (GOI, 1999).

Districtwise values of cropping intensity during the periods of 1995-2000,
2000-05 and 2005-10 are presented in Table 5.22. For the state of U.P., cropping intensity during 1995-2000, was 146 per cent. Attaining a growth of 3.01 and 1.94 per cent, it increased to 151 and 154 per cent, respectively during the period of 2000-05 and 2005-10. Very high cropping intensity (above 170 per cent) during 1995-2000 was observed in the districts namely, Rampur (181), Maharajganj (174) and Bulandshahr (171). The districts included within this category were namely, Rampur (185), Maharajganj (178), Barabanki (178), Chandauli (174) and Moradabad (171) during 2000-05. During the period of 2005-10, number of districts in this category increased to 13 with the addition of Mainpuri (188), Aligarh (173), Shahjahanpur (171), Bulandshahr (171), S.K.Nagar (171), Azamgarh (171), Pilibhit (170) and Budaun (170) districts.

There were 18 districts in the category of high cropping intensity (155 to 170 per cent) during the previous period, the number of districts increased in order of 25 and 21 during 2000-05 and 2005-10, respectively. High intensity of cropping was confined to all areas belonging to western and eastern parts of the state, where irrigation is well developed with high share of gross cropped area. In the category of medium cropping intensity in between 140 and 155 per cent, the number of districts decreased from 29 to 24 in later period. There were altogether 18 districts to represent low and very low categories of cropping intensity during 1995-2000, whereas, during 2000-05 and 2005-10, the number of districts decreased to 11 and 12, respectively (Figs. 5.23, 5.24 and 5.25).

During 1995-2000 to 2000-05, there were 7 and 5 districts, respectively which attained high growth of above 10 per cent in intensity of cropping. There were 41 and 40 districts, respectively which recorded medium growth of 0-10 per cent during these periods, respectively. Low growth in cropping intensity was recorded in 20 and 24 districts, whereas very low growth was seen in Sonbhadra district during later period (Table 5.23).

F. Cropping Intensity vs. Irrigated area: Correlative Assessment

Karl Pearson's correlation of coefficient (r) technique was used and t-test was performed to test the significance level between the components of irrigation and cropping intensity. Simple linear regression technique was also applied to evaluate the impact of irrigation (independent variable) on cropping intensity (dependent variable). Table 5.24 shows coefficient values of the variables of cropping intensity,
Table 5.22 Districtwise intensity of cropping in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category (Per cent)</th>
<th>1995-2000</th>
<th>2000-05</th>
<th>2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Name of district</td>
<td>No.</td>
</tr>
<tr>
<td>Very high (Above 170)</td>
<td>3</td>
<td>Rampur, Maharajganj and Bulandshahr</td>
<td>5</td>
</tr>
<tr>
<td>Low (125-140)</td>
<td>11</td>
<td>Kanpur Dehat, Sitapur, Bahraich, Allahabad, Balia, Kanpur, Bijapur, Meerut, Lalitpur, Kushinamali, Etawah and Faizabad</td>
<td>5</td>
</tr>
<tr>
<td>Very low (Below 125)</td>
<td>7</td>
<td>Banda, G.B. Nagar, Malwa, Chitrakoot, Jhansi and Hamirpur</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: Data for Auraiya and Ambedkar Nagar districts was not available during the period of 1995-2000.
Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.

Table 5.23 Growth in intensity of cropping in Uttar Pradesh

<table>
<thead>
<tr>
<th>Category</th>
<th>Range (per cent)</th>
<th>1995-2000 to 2000-05</th>
<th>2000-05 to 2005-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Above 10</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Medium</td>
<td>0 to 10</td>
<td>41</td>
<td>40</td>
</tr>
<tr>
<td>Low</td>
<td>-10 to 0</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Very low</td>
<td>Below -20</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.
Fig. 5.24

UTTAR PRADESH
Cropping Intensity
2000-05

(Per cent)
Very high
High
Medium
Low
Very low
Above 170
155-170
140-155
125-140
Below 125

20 30 40 50 60 70 80 100
km
net irrigated area, area irrigated more than once and different sources of irrigation.

Cropping intensity presents a high positive correlation with net irrigated area and area irrigated more than once during the corresponding period, and marked with coefficient values of 0.701 for net irrigated area, and 0.700 for more than once irrigated area, respectively at 1 per cent significance level. Area irrigated more than once has indicated a high positive correlation with net irrigated area with coefficient value of 0.632 with 1 per cent significance level. It has been illustrated in Table 5.22 that, high cropping intensity (170 to 190 per cent) in the districts of Rampur, Mainpuri, Barebanki, Chandauli, Maharajganj, Moradabad, Aligarh, Shahjahanpur, Bulandshahr, S.K.Nagar, Azamgarh, Pilibhit and Budaun during 2005-10 were because of high net irrigated area and area irrigated more than once in these districts. Whereas, the districts of Chitrakoot, Hamirpur, Banda, Jalaun, Mahoba of Bundelkhand and Sonbhadra of Purvanchal recorded lowest cropping intensity (less than 125 per cent) due to low percentage of net irrigated area and area irrigated more than once.

With respect to sourcewise irrigated area, only tubewell irrigated area showed a positive correlation with cropping intensity with the magnitude of 0.361 for private tubewells and 0.338 for total tubewells. A significant and high positive

Table 5.24 Correlation matrix of variables of cropping intensity and sourcewise irrigated area in Uttar Pradesh, 2005-10

<table>
<thead>
<tr>
<th>Variables</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>
</tr>
</thead>
<tbody>
<tr>
<td>X₁</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₂</td>
<td>.701**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₃</td>
<td>.700**</td>
<td>.632**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₄</td>
<td>-1.193</td>
<td>-2.333</td>
<td>-0.999</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₅</td>
<td>-1.156</td>
<td>-1.152</td>
<td>-0.707</td>
<td>0.049</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₆</td>
<td>.361**</td>
<td>.480**</td>
<td>.229</td>
<td>-7.68**</td>
<td>-1.148</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₇</td>
<td>.338**</td>
<td>.461**</td>
<td>.221</td>
<td>-7.64**</td>
<td>0.049</td>
<td>.980**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₈</td>
<td>-2.12</td>
<td>-3.36**</td>
<td>-1.121</td>
<td>-0.74</td>
<td>-1.136</td>
<td>-5.40**</td>
<td>-5.72**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₉</td>
<td>-2.12</td>
<td>-4.14**</td>
<td>-1.185</td>
<td>3.00**</td>
<td>-0.666</td>
<td>-6.49**</td>
<td>-6.68**</td>
<td>.601**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>X₁₀</td>
<td>-0.88</td>
<td>-2.76**</td>
<td>-2.42**</td>
<td>.032</td>
<td>-0.061</td>
<td>-3.50**</td>
<td>-3.64**</td>
<td>.464**</td>
<td>.746**</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: **. Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

X₁-Cropping intensity (Per cent); X₂-Net irrigated area to net sown area (Per cent); X₃-More than once irrigated area to net sown area (Per cent); X₄-Canal irrigated area to net irrigated area (Per cent); X₅-Irrigated area through government tubewells to net irrigated area (Per cent); X₆-Irrigated area through private tubewells to net irrigated area (Per cent); X₇-Total tubewell irrigated area to net irrigated area (Per cent); X₈-Other wells irrigated area to net irrigated area (Per cent); X₉-Tank irrigated area to net irrigated area (Per cent); X₁₀-Other means irrigated area to net irrigated area (Per cent).

Source: Bulletin of Agricultural Statistics (various issues), Directorate of Agriculture, Lucknow.
Fig. 5.26 Relationship between Cropping Intensity and Irrigated Area in Uttar Pradesh, 2005-10
A close look of table highlights the fact that canal irrigated area in the state shows a low but negative relationship with cropping intensity with the coefficient value of -0.193. A negative correlation was also observed in canal irrigated area, net irrigated area and area irrigated more than once. This shows that high tubewell irrigated area has played a powerful role in increasing the net irrigated area in the districts that lead to high cropping intensity by putting more land under irrigated cropping, in comparison to the districts which have high irrigated area under canals because tubewells provide adequate and timely irrigation and enhance the possibilities of double, triple or multiple cropping, and thus ease in increasing the area under cultivation (Narayana et al. 1982). Irrigated area by other wells and tanks presents a negative correlation. It may be concluded from Tables 5.22 and 5.24 that high cropping intensity in most of the districts of the state is an outcome of adequate and reliable supply of irrigation with modern means irrigation.

The figures 5.26 (i) to 5.26 (ix) show the linear regression considering the variables of irrigation and cropping intensity for the period of 2005-10. Figures i, ii, v and vi show least but a positive relationship of cropping intensity with net irrigated area, area irrigated more than once, private tubewells and total area irrigated by tubewells at 43.46 per cent, 37.48 per cent, 30.76 and 27.25 per cent coefficient of determination (R²), respectively.

It is depicted that the variances presented in the figures for the variables of cropping intensity are explained by the corresponding indicators of irrigation. Similarly, Figures iii, iv, vii, viii and ix manifest a negative and inverse relationship among the indicators of canal irrigated area, government tubewells irrigated area, irrigated area by other wells, tank irrigated area and irrigation through other means with cropping intensity by way of variances in order of 8.36, 2.78, 26.97, 25.79 and 7.94 per cent. These figures clearly explain the major role played by different methods of irrigation on cropping intensity in the districts of the state.
References


25. Raja, K. (2012). Complete Information on Area and Production of Wheat in


