Chapter- VI

IRRIGATION AND AGRICULTURAL DEVELOPMENT

Agriculture development of any region depends mainly upon the availability of water resources for irrigation along with the favorable quality of land and soil resources, other technological inputs, machineries, and industrial arrangement. In a developing country like India, irrigation plays the role of a catalyst and can assemble the necessary inputs and innovations along with it for the use in agriculture (Debashis Das, 1992).

Agriculture has held a dominant position in the countries economy which accounts for 75 per cent of India’s population and 80 per cent of its poor; and still after five decades of independence, they contribute 28 per cent of Gross National Product (GNP) and about 60 per cent of employment. Therefore agricultural growth is a pre-requisite for the economic and social development of our country because there is a growing concern in different quarters on the issue “Will there be enough food for our children, because it has been predicted that world is going to face acute food shortage in the next century” (Navalawala, 1999). But this major occupation is rendered hazardous by scanty rainfall in large areas and by erratic monsoon elsewhere. Partial failure or even delayed arrival of the monsoon can cause extensive damage to crops. Conscious efforts are, therefore, being made continuously to supplement rainfall and to mitigate the grave consequences of a dry spell by supplying water artificially to parched lands (Mamoria, 1991).

Agriculture in India through its multifarious relationships has bearing on the industrial, urban, technological, and social development. Agriculture
itself is a system composed of multiple components and productivity measures the efficiency of the entire agricultural system.

The importance of irrigation in the Indian context is mainly because in the broad framework of soil and climate complex, irrigation has a protective role against the uncertainty of monsoon, secondly even with given technology, mere provision of assured water supply can boost the productivity of existing input and thirdly, for the introduction of new technology irrigation acts as catalytic agent and one of the crucial factors in the package of improved inputs and new technology (Dasgupta, 1980).

It is clear that, under all circumstances, increasing irrigation facilities makes important contributions to the agricultural development and that, within considerable limits at least; it is one of the pre-conditions which must be established before a take-off into self sustained economic growth becomes possible. The principal objective of this chapter is to find out empirically as to what extent this theoretically postulated relationship between irrigation and agricultural development holds true in the area under study. It would be worth while to test this hypothesis and to find out whether or not the high irrigation development regions of Azamgarh district are well developed agricultural regions. A comparative study of irrigation and agricultural development will give significant result. To determine the levels of irrigation and agricultural development, composite z-scores of variables of irrigation and agricultural development are constructed. These scores are further standardized to zero mean and unit variance for interpretation.
Table 6.1
Levels of Irrigation and Agricultural Development in Azamgarh district
(1984-2004)

<table>
<thead>
<tr>
<th>Block</th>
<th>Composite Z score of I.D.</th>
<th></th>
<th>Composite Z score of A.D.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Atraulia</td>
<td>0.71</td>
<td>1.43</td>
<td>0.72</td>
<td>0.63</td>
<td>1.97</td>
</tr>
<tr>
<td>Koilsa</td>
<td>0.23</td>
<td>0.73</td>
<td>0.50</td>
<td>0.12</td>
<td>0.59</td>
</tr>
<tr>
<td>Ahraula</td>
<td>0.79</td>
<td>1.20</td>
<td>0.41</td>
<td>-0.15</td>
<td>-0.30</td>
</tr>
<tr>
<td>Maharajganj</td>
<td>-2.12</td>
<td>-2.67</td>
<td>-0.55</td>
<td>-2.80</td>
<td>-2.54</td>
</tr>
<tr>
<td>Haraiya</td>
<td>-1.59</td>
<td>-1.21</td>
<td>0.38</td>
<td>-1.34</td>
<td>-1.49</td>
</tr>
<tr>
<td>Bilariaganj</td>
<td>-1.25</td>
<td>-0.47</td>
<td>0.78</td>
<td>-0.09</td>
<td>0.44</td>
</tr>
<tr>
<td>Azmatgarh</td>
<td>-0.16</td>
<td>0.68</td>
<td>0.84</td>
<td>0.98</td>
<td>1.16</td>
</tr>
<tr>
<td>Tahbarpur</td>
<td>-0.68</td>
<td>-0.88</td>
<td>-0.20</td>
<td>-0.53</td>
<td>-0.29</td>
</tr>
<tr>
<td>Mirzapur</td>
<td>-0.77</td>
<td>-0.06</td>
<td>0.71</td>
<td>-0.69</td>
<td>0.44</td>
</tr>
<tr>
<td>Mohammadpur</td>
<td>-0.41</td>
<td>-0.37</td>
<td>0.04</td>
<td>0.26</td>
<td>-0.18</td>
</tr>
<tr>
<td>Rani-ki-sarai</td>
<td>0.31</td>
<td>1.17</td>
<td>0.86</td>
<td>0.35</td>
<td>0.51</td>
</tr>
<tr>
<td>Palhani</td>
<td>1.73</td>
<td>0.61</td>
<td>-1.12</td>
<td>2.34</td>
<td>1.49</td>
</tr>
<tr>
<td>Sathiavon</td>
<td>0.46</td>
<td>-0.49</td>
<td>-0.95</td>
<td>0.26</td>
<td>-0.28</td>
</tr>
<tr>
<td>Jahanaganj</td>
<td>-0.06</td>
<td>-0.44</td>
<td>-0.38</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Pawai</td>
<td>0.3</td>
<td>0.09</td>
<td>-0.21</td>
<td>-0.43</td>
<td>-0.04</td>
</tr>
<tr>
<td>Phoolpur</td>
<td>0.59</td>
<td>-0.44</td>
<td>-1.03</td>
<td>0.35</td>
<td>-0.14</td>
</tr>
<tr>
<td>Martinganj</td>
<td>-1.42</td>
<td>0.11</td>
<td>1.53</td>
<td>-1.00</td>
<td>-1.13</td>
</tr>
<tr>
<td>Thekma</td>
<td>0.29</td>
<td>-1.15</td>
<td>-1.44</td>
<td>0.20</td>
<td>-0.92</td>
</tr>
<tr>
<td>Lalganj</td>
<td>0.92</td>
<td>1.25</td>
<td>0.33</td>
<td>0.15</td>
<td>0.05</td>
</tr>
<tr>
<td>Mehnagar</td>
<td>1.27</td>
<td>0.78</td>
<td>-0.49</td>
<td>1.02</td>
<td>0.67</td>
</tr>
<tr>
<td>Tarwa</td>
<td>0.86</td>
<td>0.12</td>
<td>-0.74</td>
<td>0.33</td>
<td>-0.07</td>
</tr>
</tbody>
</table>

Note: I.D- Irrigation Development, A.D. Agricultural Development


Levels of Irrigation Development

Agriculture development is the result of many factors and among them irrigation is the most important. It improves agriculture to a significant measure and acts as a tool of development in agriculture pursuits (Rego, 1999).

Irrigation is identified as a decisive factor in Indian agriculture due to high variability and inadequacy of rainfall. Irrigation is imperative for successful agriculture particularly in arid, semi-arid and sub-humid areas which are prone to drought and famine conditions due to partial failure and delayed arrival or early withdrawal of the monsoons (Reddy, 1992).
Agriculture has been the main user of water resource on earth, and it has also been identified as a major source of wastage of the resource. Owing to the rapid growth of population and development of other sectors besides agriculture in most of the countries, water is becoming a scare resource and most costly to develop. Most of the water needed for agriculture is irrigation water, and it is a forgone conclusion that irrigation is vital for irrigation development (Ahmad, 2007).

Although irrigation plays a vital role in the development of agriculture in Azamgarh district, but still the development and utilization of irrigation varies from one block to another. So it was thought worthwhile to delineate homogeneous areas having same characteristics of irrigation development in Azamgarh district on the basis of composite z-scores of eight variables.

**Variables of Irrigation Development**

X₁. Percentage of gross irrigated area to gross cultivated area

X₂. Percentage of net irrigated area to net cultivated area

X₃. Percentage of double irrigated area to net irrigated area

X₄. Percentage area sown more than once to net sown area

X₅. No. of tube wells and pump sets/10000 ha of cultivated area

X₆. Intensity of irrigation

X₇. Percentage area under canal to net irrigated area

X₈. Percentage area under tube well to net irrigated area

The regional variations are summarized by classifying the blocks into high (More than \( \bar{X} + 0.5\text{SD} \)), medium (\( \bar{X} +0.5\text{SD} \) to \( \bar{X} -0.5\text{SD} \)) and low (Less than \( \bar{X} -0.5\text{SD} \)) levels for the years of 1984 and 2004 (Fig 6.1).
Spatial Patterns of Levels of Irrigation Development

Fig. 6.1A shows that during 1984, with the exception of Palhani block, north-western and south eastern blocks of the district enjoyed with high level of irrigation development comprising of seven blocks. It is mainly because these areas have well developed tube wells and canals irrigation facilities. The region of moderate irrigation development is mainly concentrated in south eastern-part of the district excluding two blocks of Pawai and Koilsa located in north-west corner of the district. The low level of irrigation development stretching from Haraiya and Maharajganj blocks in the north-east to Martinanaj block in south-west comprises of six blocks. It is generally due to low fertility of soils and lack of irrigation facilities. These drawbacks are added with the low level of technological development in the area. Whereas, in 2004, the blocks of high levels of irrigation development are mostly confined to the north-western and south-central parts of the district. Major portion (western and eastern) of the district is devoted to moderate level of irrigation development while, the blocks of Haraiya, Maharajganj and Tahbarpur had continued as low developed regions, whereas, the blocks of Thekma which was under medium level during 1984 has come down to low level during 2004 (Fig. 6.1B).

The period under investigation (1984-2004) has witnessed significant change in the level of irrigation development. However, its spatial pattern at block level deviates much. The figure varies from -1.44 in Thekma block to 0.86 in Rani-ki-Sarai block (Table 6.1). Figure 6.1C depicts that one third of the total blocks witnessed high change in the level of irrigation development and constitutes three regions in the district.
AZAMGARH DISTRICT
Levels of Irrigation Development
(Based on composite z score)

(A) 1984
(B) 2004
(C) Change (1984-2004)

Fig. 6.1
The first region lies in west-central portion of the district comprising the blocks of Martinganj, Mirzapur and Rani-ki-Sarai and other two are located in north and north-eastern parts of the district. The medium category blocks are mostly concentrated in north-western and south-eastern parts except the block of Haraiya located in north-eastern corner of the district. Remaining blocks recorded low change in the levels of irrigation development, but these blocks are too apart from each other to make any identifiable region in the district (Fig.6.1C).

Levels of Agricultural Development

Agricultural development is a multi-dimensional concept which mainly includes development in areal strength of cropped land, improvement in farming practices/systems, improved farm implements, irrigation system and irrigated area, high yielding improved varieties of seeds, chemical fertilizers, insecticides and pesticides, intensity of cropping and specialization and commercialization of agriculture (Mohammad, 1981).

Agricultural development in a true sense denotes the quality of the agricultural system of a region in terms of productivity, diversification and commercialization and consistent with a desired state of agrarian relations and ecological balance. The level and rate of agricultural development may also be distinguished: the former represents a picture prevailing at a particular point in time, while, the latter stands for the progress achieved over a given period. If the process of agricultural development is regulated in a systematic line, it becomes agricultural planning. The development of agriculture is to be judged from the degree of equity in farm incomes and agrarian relations (Naregal, 1991).
Agriculture is one of the leading sectors of Indian economy. It plays a significant role in determining varying nature of agro-economic activities. Its influence on overall development may greatly be felt from the fact that about two-third of the country's population gets livelihood directly or indirectly from agriculture. The levels of agricultural development play a vital role for socio-economic development of any area in general and rural area in particular.

In order to find out the level of agricultural development in the study area, selected indices were measured for each block. The following variables are considered for determining the level of agricultural development on the basis of composite standardized z-scores.

**Variables of Agricultural Development**

- $Y_1$. percentage of net sown area to the total reported area
- $Y_2$. Percentage area sown more than once to net sown area
- $Y_3$. Percentage of gross irrigated area to gross cultivated area
- $Y_4$. Consumption of fertilizers (kg/ha)
- $Y_5$. Tractors /10000 ha of cultivated area
- $Y_6$. Percentage of agricultural workers to the total workers
- $Y_7$. No. of co-operative societies and rural bank/one lack population
- $Y_8$. Length of metalled road in km 1000 sqkm of area
- $Y_9$. Cropping intensity
- $Y_{10}$. Yield of foodgrains (in quintal/ha of cultivated area)
- $Y_{11}$. Percentage of electrified villages to total villages
- $Y_{12}$. Literacy rate
The regional variations are summarized by classifying the blocks into high (More than $\bar{X} + 0.5SD$), medium ($\bar{X} +0.5SD$ to $\bar{X} -0.5SD$) and low (Less than $\bar{X} -0.5SD$) grades for the years of 1984 and 2004 (fig 6.2)

Spatial Pattern of Levels of Agricultural Development

The spatial patterns of levels of agricultural development show that in 1984, four blocks namely, Atraulia, Palhani, Azamtgarh and Mehnagar come under high level of agricultural development due to the high value of some of its variables. These blocks are too apart to each other to make any identifiable region (Fig. 6.2A). More than half of the blocks of the district fall under the medium level of agricultural development, which forms mainly two regions with the exception of Atraulia and Mehnagar blocks. One region lies in south-eastern part of the district comprising of eight blocks and the second region occurs in north-western corner of the district consisting of four blocks of Koilsa, Ahraula, Pawai and Phoolpur. Whereas, the blocks of low levels of agricultural development stretching from Haraiya and Maharajganj blocks of north-east to Martinganj block in south-west comprise five blocks (Fig. 6.2A). It is mainly due to low fertility of soils, poor irrigation facilities and inaccessibility

In 2004, the blocks of Koilsa and Rani-ki-Sarai are added with high level of agricultural development. Almost all the blocks except Koilsa, Rani-ki-Sarai and Thekma which were under medium level of agricultural development during 1984 have continued in the same level, whereas, Atraulia and Rani-ki-Sarai which were under medium category had changed to high category in 2004. While Tahbarpur and Mirzapur blocks have improved their
Fig. 6.2

AZAMGARH DISTRICT
Levels of Agricultural Development
(Based on composite z-score)

(A) 1984

(C) Change (1984-2004)

(B) 2004

Km

High

Mean

Low

+0.50

-0.50
situation from low to medium level. The Thekma block which was under medium level in 1984 further came down to low level in 2004 (Fig. 6.2B).

The period under study (1984-2004) has witnessed significant change in the levels of agricultural development; however, its spatial pattern at block level varies much. It varies from -1.12 in Thekma block to 1.34 in Atraulia block (Table 6.1) The entire range of variation may be grouped into three grades of high, medium and low (Fig. 6.2C).

The combined impact of twelve variables revealed that more than two third blocks of the district have medium change. These blocks cover almost whole northern, southern and western portion of the district. High change is found in the blocks of Atraulia, Bilariaganj and Mirzapur, while low change in the levels of agricultural development is noted in three blocks of Sathiavon, Palhani and Thekma (Fig. 6.2B).

It is evident that irrigation, the basic input in agriculture has played a vital role in forming different regions of levels of development, as other variables too have contributed their due share only after assured water supply becomes available. As a result distinct disparities in levels of development have emerged in the study area. In general, the developments are commensurate to the degree of development of irrigation.

**Relationship between Irrigation and Agricultural Development**

Previously, an attempt has been made to discuss the levels of irrigation and agricultural developments in detail. Now it would be worthwhile to analyze the irrigational development in relation to agricultural development in Azamgarh district. Here an attempt has been taken to analyze the relationship between irrigation and agricultural development for the period of 1984 and
2004. Their relationship has been established with diagrammatic presentation through the comparison of maps of levels of irrigation development and levels of agricultural development. The abscissa represents irrigation development and ordinate refers the agricultural development. The blocks with reference to composite standardized z-scores may be arranged into three categories of high (above 0.50 score), medium (-0.50 to 0.50 score) and low (below -0.50 score) for irrigation development and agricultural development as well as for the period of 1984 and 2004.

**Irrigation Development vis-à-vis Agricultural Development (1984)**

The relationship between irrigation and agricultural development in 1984 is diagrammatically shown figure 6.3. The figure reveals that three blocks, i.e. Atraulia, Palhani and Mehnagar form the integrated region of high level of both irrigation development as well as agricultural development. But the integrated region of development is not a compact rather scattered in three different parts of the district. On the contrary, the integrated region of low level of both irrigation and agricultural development is appeared in continuous forms stretching diagonally from north-east to south-west. This integrated region of low level of development comprises of five blocks of Azamgarh district, i.e. Haraiya, Maharajganj, Tahbarpur, Mirzapur and Martinganj. It is also seen from the figure that not a single block of the district comes under the differentiated region of high level of irrigation and low level agricultural development or low level of irrigation and high level agricultural development (Fig.6.3). Seven blocks of the district, i.e. Koilsa, Pawai, Sathiavon, Jahanaganj, Rani-ki-Sarai, Mohammadpur and Thekma come under the integrated region of medium level of both irrigation and agricultural development (Fig.6.3). Four blocks come under the differentiated region of
high level of irrigation development with medium level of agricultural development which makes two regions, one lies in south-eastern and other

AZAMGARH DISTRICT
IRRIGATION DEVELOPMENT
Vls-a-VIs
AGRICULTURAL DEVELOPMENT
(1984)

Fig. 6.3

located in north-western part of the district. While remaining two blocks, namely, Azamatgarh and Bilariaganj fall under differentiated region of high level of agricultural development with medium level irrigation development
and medium level of agricultural development along with low level of irrigation development respectively (Fig. 6.3).

**Irrigation Development vis-à-vis Agricultural Development (2004)**

The interrelationship between irrigation development and agricultural development during 2004 is depicted in Fig. 6.4. The figure reveals that six blocks come under the integrated region of high level of both irrigation development as well as agricultural development. It forms two regions, one region lies in south-eastern part of the district comprising of four blocks of Azamatgarh, Palhani, Rani-ki-Sarai and Mehnagar other one consists of two blocks of Atraulia and Koilsa situated in north-western corner of the district. On the other hand the integrated region of low level of both irrigation and agricultural development, consist of three blocks. Out of them two blocks, i.e., Maharajganj and Haraiya are observed in the north-eastern part of the district. Whereas, remaining block, namely, Thekma of same group is found in the southern part of the district. A dominant region of integrated region of medium level of both irrigation and agricultural development, makes two region consisting of four blocks each situated in western and south-eastern portion of the district respectively (Fig. 6.4). It is also clear from the figure that not a single block of the district come under the differentiated region of high level of agricultural development and low level of irrigation development. Two blocks i.e. Ahraula and Lalganj of high level of irrigation development with medium level of agricultural development are scatteredly distributed and fail to make any identifiable region in the district. It is mainly because of some other factors such as infertility of soils and fertilizers are responsible of low level of
agricultural development. While the blocks namely, Martinganj and Tahbarpur of differentiated region of medium level of irrigation development with low level of agricultural development and low level of irrigation development with medium level of agricultural development are identified in south-western and central portion of the study area respectively (Fig. 6.4).
Correlation between Irrigation and Agricultural Development (1984)

Based on technique of Karl Pearson’s coefficient of correlation, an attempt has been made to analyze the nature and extent of correlation between the independent variables (variables of irrigation development) and dependent variables (variables of agricultural development). Table 6.2 reveals that independent variable $X_1$ (percentage of gross irrigated to cross cultivated area) is positively correlated with all the variables of agricultural development except $Y_7$ (No. of co-operative societies and rural bank/one lack population). $X_1$ positively associated with $Y_3$ having ‘r’ value of 0.991 significant with 1 per cent level of significance. There is a positive correlation between of $X_1$ and $Y_8$ ($r = 0.433$) and are significant at five per cent level. The variable $X_2$ (percentage of net irrigated area to net cultivated area) is negatively correlated to variables $Y_5$, $Y_6$, $Y_7$ and $Y_{10}$ though not up to the level of acceptance. The independent variable $X_2$ is high positively correlated to $Y_3$ with ‘r’ value of 0.811, which is significant at 1 per cent level. Again $X_2$ is positively correlated with significance at 5 per cent level with the dependent variables of $Y_2$ ($r = 0.460$), $Y_8$ ($r = 0.402$), and $Y_9$ ($r = 0.528$). Table 6.2 shows that variable $X_3$ has very insignificant negative correlation with $Y_1$ ($r = -0.001$), $Y_7$ ($r = -.186$), $Y_8$ ($r = -0.050$) and $Y_{11}$ ($r = -0.015$). Among the positive correlations of $X_3$ with rest of variables of agricultural development, only $Y_{10}$ ($r = 0.638$) is significant at 1 per cent level. Variable $X_4$ has strong negative correlation with $Y_5$ and $Y_6$ with ‘r’ value of -0.477 and -0.527 respectively. But it is ($X_4$) positively correlated to $Y_{12}$ ($r = 0.414$) significant at 1 per cent level. However, $X_4$ has high degree of positive correlation with $Y_2$ ($r = 0.999$) and $Y_9$ ($r = 0.618$) which are significant at 1 per cent level of confidence. Variable $X_5$ is insignificantly negatively correlated to $Y_1$ ($r = -0.137$), $Y_7$ ($r = -0.149$) and $Y_{11}$ ($r = -0.201$).
Table 6.2
Correlation between the Variables of Irrigation and Agricultural Development (1984)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Y_1</th>
<th>Y_2</th>
<th>Y_3</th>
<th>Y_4</th>
<th>Y_5</th>
<th>Y_6</th>
<th>Y_7</th>
<th>Y_8</th>
<th>Y_9</th>
<th>Y_{10}</th>
<th>Y_{11}</th>
<th>Y_{12}</th>
</tr>
</thead>
<tbody>
<tr>
<td>X_1</td>
<td>0.243</td>
<td>0.050</td>
<td>0.991*</td>
<td>0.291</td>
<td>0.221</td>
<td>0.051</td>
<td>-0.098</td>
<td>0.433*</td>
<td>0.364</td>
<td>0.123</td>
<td>0.198</td>
<td>0.303</td>
</tr>
<tr>
<td>X_2</td>
<td>0.307</td>
<td>0.460*</td>
<td>0.811*</td>
<td>0.260</td>
<td>-0.026</td>
<td>-0.273</td>
<td>-0.065</td>
<td>0.402*</td>
<td>0.528*</td>
<td>-0.172</td>
<td>0.045</td>
<td>0.393</td>
</tr>
<tr>
<td>X_3</td>
<td>-0.001</td>
<td>0.064</td>
<td>0.022</td>
<td>0.255</td>
<td>0.392</td>
<td>0.176</td>
<td>-0.186</td>
<td>-0.050</td>
<td>0.307</td>
<td>0.638*</td>
<td>-0.015</td>
<td>0.061</td>
</tr>
<tr>
<td>X_4</td>
<td>-0.314</td>
<td>0.999*</td>
<td>0.047</td>
<td>0.315</td>
<td>-0.477*</td>
<td>-0.527*</td>
<td>-0.005</td>
<td>0.384</td>
<td>0.618*</td>
<td>0.017</td>
<td>-0.12</td>
<td>0.414*</td>
</tr>
<tr>
<td>X_5</td>
<td>-0.137</td>
<td>0.002</td>
<td>0.503*</td>
<td>0.631**</td>
<td>0.679**</td>
<td>0.127</td>
<td>-0.149</td>
<td>0.540*</td>
<td>0.152</td>
<td>0.318</td>
<td>-0.201</td>
<td>0.139</td>
</tr>
<tr>
<td>X_6</td>
<td>-0.453*</td>
<td>0.017</td>
<td>0.119</td>
<td>0.255</td>
<td>0.262</td>
<td>0.258</td>
<td>0.091</td>
<td>-0.044</td>
<td>0.601*</td>
<td>0.0966*</td>
<td>0.185</td>
<td>-0.091</td>
</tr>
<tr>
<td>X_7</td>
<td>-0.104</td>
<td>-0.116</td>
<td>-0.072</td>
<td>-0.262</td>
<td>0.161</td>
<td>0.312</td>
<td>-0.368</td>
<td>-0.282</td>
<td>0.014</td>
<td>0.199</td>
<td>0.412*</td>
<td>-0.248</td>
</tr>
<tr>
<td>X_8</td>
<td>0.158</td>
<td>0.116</td>
<td>0.163</td>
<td>0.241</td>
<td>-0.148</td>
<td>-0.315</td>
<td>0.390</td>
<td>0.245</td>
<td>0.037</td>
<td>-0.134</td>
<td>0.403*</td>
<td>0.265</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 per cent level (2-tailed)
* Correlation is significant at the 0.05 per cent level (2-tailed)
However, $X_5$ is positively correlated to rest of the variables, but their relationship is found significant at 5 per cent level with $Y_3$ ($r = 0.503$), $Y_8$ ($r = 0.540$) and significant at 1 per cent level with $Y_4$ ($r = 0.631$) and $Y_5$ ($r = 0.679$).

Table 6.2 further reveals that the variable irrigation intensity ($X_6$) has high degree of positive impact on yield of foodgrains and cropping intensity with ‘$r$’ value of 0.996 and 0.601 respectively which is significant at 1 per cent level. This shows that cropping patterns are largely determined by the extension of irrigation facilities. $X_6$ has positive bearing on all the variables of agricultural development except variable $Y_4$, $Y_8$ and $Y_{12}$ which are negatively correlated (Table 6.2).

**Correlation between Irrigation and Agricultural Development (2004)**

Based on the technique to Karl Pearson’s coefficient of correlation, the present analysis is an attempt to identify the relationship between the variables of irrigation and agricultural development during 2004. Table 6.3 reveals that the variable $X_1$ (percentage of Gross irrigated area to gross cultivated area) is positively associated with most of the variables of agricultural development except $Y_6$ (percentage of agricultural workers to the total workers) and $Y_7$ (No. of co-operative societies and rural bank/one lack population) with ‘$r$’ value of -0.282 and -0.249 respectively. Among them, $X_1$ is highly positively correlated with $Y_3$ ($r = 0.978$) at 1 per cent level of significance, While with $Y_8$ ($r = 0.482$) and $Y_{12}$ ($r = 0.511$) which are significant at 5 per cent level. The independent variable $X_2$ (Percentage of net irrigated area to net cultivated area) is negatively correlated with $Y_6$ ($r = -0.373$) and $Y_{10}$ ($r = -0.135$) which are not
Table 6.3
Correlation between the Variables of Irrigation and Agricultural Development (2004)

<table>
<thead>
<tr>
<th>Variables</th>
<th>$Y_1$</th>
<th>$Y_2$</th>
<th>$Y_3$</th>
<th>$Y_4$</th>
<th>$Y_5$</th>
<th>$Y_6$</th>
<th>$Y_7$</th>
<th>$Y_8$</th>
<th>$Y_9$</th>
<th>$Y_{10}$</th>
<th>$Y_{11}$</th>
<th>$Y_{12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_1$</td>
<td>0.161</td>
<td>0.016</td>
<td>0.978**</td>
<td>0.228</td>
<td>0.323</td>
<td>-0.282</td>
<td>-0.249</td>
<td>0.482*</td>
<td>0.203</td>
<td>0.391</td>
<td>0.303</td>
<td>0.511*</td>
</tr>
<tr>
<td>$X_2$</td>
<td>0.293</td>
<td>0.399</td>
<td>0.268</td>
<td>0.110</td>
<td>0.433*</td>
<td>-0.373</td>
<td>-0.436*</td>
<td>0.426</td>
<td>0.551**</td>
<td>-0.135</td>
<td>0.562**</td>
<td>0.624**</td>
</tr>
<tr>
<td>$X_3$</td>
<td>0.443*</td>
<td>0.206</td>
<td>0.375</td>
<td>0.019</td>
<td>0.482*</td>
<td>-0.599*</td>
<td>0.091</td>
<td>0.434*</td>
<td>0.610**</td>
<td>0.381</td>
<td>-0.026</td>
<td>0.446*</td>
</tr>
<tr>
<td>$X_4$</td>
<td>0.558**</td>
<td>0.985**</td>
<td>-0.094</td>
<td>-0.670**</td>
<td>-0.079</td>
<td>-0.515*</td>
<td>0.319</td>
<td>-0.094</td>
<td>0.253</td>
<td>-0.411</td>
<td>0.233</td>
<td>0.173</td>
</tr>
<tr>
<td>$X_5$</td>
<td>-0.349</td>
<td>-0.312</td>
<td>0.344</td>
<td>0.504*</td>
<td>0.238</td>
<td>0.234</td>
<td>-0.646**</td>
<td>0.158</td>
<td>-0.129</td>
<td>0.177</td>
<td>0.248</td>
<td>0.279</td>
</tr>
<tr>
<td>$X_6$</td>
<td>-0.089</td>
<td>-0.357</td>
<td>0.420*</td>
<td>0.484*</td>
<td>0.415</td>
<td>0.147</td>
<td>-0.158</td>
<td>0.270</td>
<td>0.612**</td>
<td>0.985**</td>
<td>-0.043</td>
<td>0.228</td>
</tr>
<tr>
<td>$X_7$</td>
<td>0.072</td>
<td>0.404</td>
<td>-0.101</td>
<td>-0.371</td>
<td>-0.294</td>
<td>0.103</td>
<td>-0.138</td>
<td>-0.291</td>
<td>-0.099</td>
<td>-0.367</td>
<td>0.068</td>
<td>0.216</td>
</tr>
<tr>
<td>$X_8$</td>
<td>-0.050</td>
<td>-0.381</td>
<td>0.070</td>
<td>0.359</td>
<td>0.282</td>
<td>-0.115</td>
<td>0.136</td>
<td>0.281</td>
<td>0.116</td>
<td>0.327</td>
<td>0.501*</td>
<td>-0.232</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 per cent level (2-tailed)
* Correlation is significant at the 0.05 per cent level (2-tailed)
significant up to the acceptance level, but in case of \( Y_7 \) \( (r = -0.436) \) it is significant at 5 per cent level. However, \( X_2 \) is positively associated with rest of the variables of agricultural development. Variable \( X_2 \) positively correlated with variable \( Y_5 \) (tractors per/10000 ha of cultivated area) at 5 per cent level of significance with ‘\( r \)’ value of 0.433, while with \( Y_9 \) \( (r = 0.551) \), \( Y_{11} \) \( (r = 0.562) \) and \( Y_{12} \) \( (r = 0.624) \) is significant at 1 per cent level. It shows the great influence of irrigated area with that of cropping intensity, electrified villages, use of tractors and literacy rate. The variable \( X_3 \) (percentage of double irrigated area to net irrigated area) is highly negatively correlated to \( Y_6 \) (percentage of agricultural workers to the total workers) with ‘\( r \)’ value -0.599. But it is strongly correlated to cropping intensity \( (Y_9) \) with ‘\( r \)’ value 0.610 which is significant at 1 per cent level of confidence. \( X_3 \) is also significantly associated with \( Y_1 \) \( (r = 0.443) \), \( Y_5 \) \( (r = 0.482) \), \( Y_8 \) \( (r = 0.434) \), and \( Y_{12} \) \( (r = 0.446) \) which are significant at 5 per cent level. The independent variable \( X_4 \) (percentage area sown more than once to net sown area) reveals high positive correlation with \( Y_1 \) \( (r = 0.558) \), and \( Y_2 \) \( (r = 0.985) \) while negatively correlated with \( Y_4 \) \( (r = -0.670) \) at 1 per cent level of significance and with \( Y_6 \) \( (r = -0.515) \) at 5 per cent level of significance. Variable \( X_5 \) (no. of tube wells and pump sets/ 10000 ha of cultivated area) is either insignificantly or negatively correlated with all the variables of agricultural development (Table 6.4). The variable intensity of irrigation \( (X_6) \) is negatively associated with \( Y_1 \) \( (r = -0.349) \), \( Y_2 \) \( (r = -0.357) \), \( Y_7 \) \( (r = -0.158) \) and \( Y_{11} \) \( (r = -0.043) \) which are not significant up to accepted level. However, \( X_6 \) is positively related to the rest of variables of agricultural development of which highly correlated to \( Y_4 \) \( (r = 0.484) \) at 5 per cent level of significance, \( Y_9 \) \( (r = 0.612) \) and \( Y_{10} \) \( (r = 0.985) \) at 1 per cent level of significance. It is surprising that, independent variable \( X_7 \) (percentage area
under canal to net irrigated area) is negatively correlated to majority of the variables of agricultural development with very poor degree of correlation. The variable $X_7$ is neither positively nor negatively correlated to any variables of agricultural development with higher degree of correlation. It shows that canal irrigation does not have significant role in the development of agriculture in Azamgarh district. Whereas variable $X_8$ (Percentage area under tube well to net irrigated area) though insignificant but positively correlated with majority of the variables of agricultural development (Table 6.3).

After foregoing analysis it is observed that irrigation has a significant role in the development of agriculture in the study area. Among the variables of irrigation development, variables of irrigated area (net, double and total) and cropping intensity play greater influence on agricultural development. However, means of irrigation in the form of tube well and pump set are cause of enhancement of consumption of fertilizers in crop fields. It is analytically revealed that intensity of irrigation is the main factor which determines the cropping pattern in the district of Azamgarh.