CHAPTER IV
Keeping in view the objectives outlined for the study, time series as well as cross-sectional data were employed. In the following pages a detailed description of the procedures adapted to achieve the objectives of the study is being given:

**Data Collection:**

To compute the compound growth rates (C.G.R.) on area, production and productivity, and area elasticities of selected crops the following informations were collected, from the records of directorate of Agriculture Government of Uttar Pradesh, with respect to each crop for the state of U.P. during the period of 1955-56 to 1980-81.

(i) Area under various selected crops.
(ii) Irrigation area under various crops.
(iii) Farm harvest prices of various crops.
(iv) Farm harvest prices of competing crops.
(v) Total production of selected crops.
(vi) Total production of competing crops.
(vii) Yield per hectare of selected crops.
(viii) Yield per hectare of competing crops.
The objectives third and fourth requires primary data from cultivators. The data pertaining to land utilization for different crops, production and price were collected by conducting a survey of farmers producing mentioned crops.

**Sampling Design:**
Stratified random sampling technique was adopted for this study to select the ultimate limit of the sample. Allahabad district of Uttar Pradesh State was purposively selected because of the convenience of research work.

**Blocks:**
Chaka block of Allahabad district was selected for the study. There have been some considerations in favour of selecting Chaka block; the block is one of the developed block of the district. Almost all the crops selected for the study are grown in the block.

**Villages:**
From the Chaka block three villages namely, Bandi, Dashgah and Baghana were purposively selected (Map 2). Familiarity of the investigator with these villages has been largely responsible for their selection. It is safe to assume that if one is fairly acquainted with farmers from whom he is to collect data of the type used in this study he is likely to get better response. The details of selected village are given in table 4.1.
MAP No. 2

MAP OF CHAKA BLOCK SHOWING THE LOCATION OF VILLAGES SELECTED FOR STUDY
Table 4.1
Details of selected villages in Chaka Block of Allahabad Distt.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of villages</th>
<th>Area in ha.</th>
<th>No. of Farm House hold</th>
<th>Total population</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dandi</td>
<td>129.6</td>
<td>152</td>
<td>1251</td>
<td>635</td>
<td>586</td>
</tr>
<tr>
<td>2.</td>
<td>Dabhaw</td>
<td>160.6</td>
<td>140</td>
<td>1126</td>
<td>572</td>
<td>552</td>
</tr>
<tr>
<td>3.</td>
<td>Bagbana</td>
<td>193.2</td>
<td>163</td>
<td>1041</td>
<td>525</td>
<td>516</td>
</tr>
</tbody>
</table>

Farmers:
In the selected villages complete census of cultivating house holds was taken. From each village 30 farm house holds were selected at random from three different size groups of farm house holds (Table 4.2). The number of farmers selected in each size group was proportional to the total number of farmers of each group in all three villages.

Table 4.2
Details and the distribution of selected farmers in different size groups from selected villages of Chaka Block, Allahabad District.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of No. villages</th>
<th>No. of farm house holds</th>
<th>Size Groups growing selected crops</th>
<th>Total Farm House Holds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>below 1-2 ha 2 ha and above</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 ha. 1 2 4 1 2 3 4</td>
<td>158</td>
</tr>
<tr>
<td>1.</td>
<td>Dandi</td>
<td>48</td>
<td>20 14 15 10 13 6</td>
<td>48 30</td>
</tr>
<tr>
<td>2.</td>
<td>Dabhaw</td>
<td>52</td>
<td>23 17 17 10 12 6</td>
<td>52 30</td>
</tr>
<tr>
<td>3.</td>
<td>Bagbana</td>
<td>58</td>
<td>25 12 19 10 14 8</td>
<td>56 30</td>
</tr>
<tr>
<td>Total</td>
<td>158</td>
<td>68 40 51 30 39 20</td>
<td>158 90</td>
<td></td>
</tr>
</tbody>
</table>

T = Total; S = Selected.
Method of Enquiry:

Data pertaining to socio-economic variables such as operational holding, family size etc., and also about the allocation of area under different crops by respondents were collected by canvassing a comprehensive and well-structured schedule. (Appendix 1.6).

Survey method of inquiry was used for collection of data, selected farmers were personally contacted.

Period of Enquiry:

The study is related to the agricultural year 1964-1965.

Analytical Frame Work:

Compound Growth Rate:

Compound growth rates (C.G.R.) of area, production and productivity of wheat, rice, gram and groundnut were worked out by fitting exponential functions to the original data of area, production and productivity with 1958-1959 as base year through 1960-1961. Changes in productivity per unit (hectare) of land were measured. Using the least square method, the following form of exponential function was fitted.

\[ Y = AB^t \]

Where

\[ Y = \text{Area in ha/Production and productivity of selected crops} \]

A & Constant
\[ b = 1 + \omega \]
\[ r = \text{Compound growth rate (C.G.R.)} \]
\[ t = \text{time variable in year (1, 2 to 22).} \]

**Trend Estimation:**

Besides compound growth rates, the trend movements in area production and productivity of wheat, rice, gram, and groundnut in U.P. were also calculated using the data from 1950-1951 to 1980-1981.

The linear equation of following form was fitted for area, production and productivity:

\[ Y = a + bX \]

Where

- \( Y \) = Area, production and productivity
- \( X \) = Year
- \( a \) = efficient
- \( c \) = intercept.

**Area elasticity:**

The analysis was done on the data for the year 1955-56 to 1980-1981. Relative prices and competing crops were also considered. One year lag was used in all independent variables except in case of irrigated area assuming that current year independent variables generally influenced the decision on land allocation for the next year’s crops.

Thus, the changes in independent variables during 1957-58 to 1979-80 have been compared with changes in area, for the

In order to study the area elasticity the variables were specified as under:

\[ A_t = f (P_{t-1}, R_{t-1}, Y_{t-1}, RY_{t-1}, P_{t-1}, RPO_{t-1}, A_{t-1}) \]

Where

- \( A_t \) = Area under the crop in thousand hectares;
- \( P_{t-1} \) = Price of crop in rupees per quintal in preceding the year.
- \( R_{t-1} \) = Relative price to competing crop in preceding the year.
- \( Y_{t-1} \) = Yield in quintal per hectare in the preceding year.
- \( RY_{t-1} \) = Relative yield to competing crop in preceding year.
- \( P_{t-1} \) = Production in thousand metric tons in the preceding year.
- \( RPO_{t-1} \) = Relative Production to competing crop in the preceding year.
- \( A_{t-1} \) = Area in thousand hectares in the preceding year.
- \( IA_t \) = Percentage of irrigated area to gross cropped area.

\[ Y_{t-1} \] = Index of variability of revenue in the preceding year.

\[ RPO_{t-1} \] = Index of variability of revenue in the preceding year.

\( T \) = Trend
The method of least square was used to estimate the regression coefficients. The form of regression equation used in the study was the Cobb-Douglas type which is linear in logarithms and yields the elasticity directly. A description of variables follows:

**Dependent variables:**

Area under the crop in the current year has been taken as the dependent variable. The actual planted area under the crop in the current year is assumed as a function of lagged year's price of that crop, lagged year's area, current year irrigated area under it, lagged year's relative price to competing crop, lagged year's yield, lagged year's production, lagged year's relative yield and production to competing crop, lagged year's revenue and per hectare revenue variability and trend.

**Independent variables:**

**Own price of the crop:**

Price is an important factor in the determination of area under the crop. Farm harvest price or the price at which the producer sells his crop at the farm site in the preceding year is taken as the lagged year's price. It's assumed that the price expected to prevent at some future data, depends in the same way on what price has been in the past year. Hence last year's harvest price was considered relevant in area decision.
Relative Price to Competing Crop:

Before planting an area under a particular crop the farmer usually has a choice of relative crops. Hence the area soon under a crop competes with relative crops. Hence the harvest price of such crop was taken to form an index of relative price. The usual procedure is to use a deflator which implicitly removes the influences of variation in the general price level and when the deflation is done by price of competing crop the problem of multi-collinearity between prices is overcome. The price of selected crops were deflated by the prices of their competing crops.

Yield of the crop in the preceding year:

Yield of crop in the preceding year affect the decision on area allocation.

Relative yield to competing crop in preceding year:

Yield per hectare of the crop has been taken and simple index has been computed as own yield per hectare of the crop over the yield of competing crop.

Production of the crop in the preceding year:

Production of the crop in the preceding year is another factor for analysis of area decision in general. Rajkrishna found that the independent variable production strongly influences the area of cotton and rice crops.
Relative production to competing crops in preceding year:

Production of the crop has been taken and simple index has been computed as own production of the crop over the production the competing crop.

Area under crop in the preceding year:

It is one of the important factor in the analysis of area decision. Nerlove said that the farmer's decision are also based on the area in the preceding year.

Irrigated area in the current year:

Farmer's decision specially for H.Y.V. Crops based on availability of irrigated area in the current year.

Per hectare revenue variability in preceding year:

The index of variability of revenue per hectare is obtained by ratio of index of revenue of own crop over the index of revenue of the competing crop.

Revenue variability in preceding years:

Index variability of revenue is obtained by ratio of index revenue of own crop over the index of revenue of competing crop. The method of computing is follows:

The coefficient of variation of own price of the crop multiplies by coefficient of production of own crop over three preceding years.
Trend variables:

This variable is included to indicate the influence on area due to the factors other than mentioned in the function. Technology may be considered as one of the factors, in influencing these trends. Trend also indicates the rate of growth of area under crop over the period of 1958-59 to 1980-81, in Uttar Pradesh.

Estimating Models:

A set of 17 Cobb-Douglas type models was specified and tried for each crop. The model specification are as under:

1. \[ \log A_t = \log a + b_1 \log P_{t-1} + \log e. \]
2. \[ \log A_t = \log a + b_1 \log P_{t-1} + b_2 \log T + \log e. \]
3. \[ \log A_t = \log a + b_1 \log R_{P_t} + \log e. \]
4. \[ \log A_t = \log a + b_1 \log R_{P_t} + b_2 \log T + \log e. \]
5. \[ \log A_t = \log a + b_1 \log P_{t-2} + b_2 \log P_{t-2} + b_3 \log P_{t-3} + \log e. \]
6. \[ \log A_t = \log a + b_1 \log P_{t-1} + b_2 \log P_{t-2} + b_3 \log P_{t-3} + b_4 \log T + \log e. \]
7. \[ \log A_{t-1} = \log a + b_1 \log P_{t-1} + b_2 \log Y_{t-1} + b_2 \log T + \log e. \]
8. \[ \log A_t = \log a + b_1 \log R_{P_{t-1}} b_2 \log R_{Y_{t-1}} + b_3 \log T + \log e. \]
9. \[ \log A_t = \log a + b_1 \log P_{t-1} + b_2 \log Y_{t-1} + b_3 \]
\[ \log P_{0_{t-1}} + \log e. \]

10. \[ \log A_t = \log a + b_1 \log P + b_2 \log Y_{t-1} + b_3 \log P_{0_{t-1}} + b_4 \log T + \log e. \]

11. \[ \log A_t = \log a + b_1 \log R_{P_{t-1}} + b_2 \log R_{X_{t-1}} + b_3 \log R_{P_{0_{t-1}}} + b_4 \log A_{t-1} + b_5 \log T + \log e. \]

12. \[ \log A_t = \log a + b_1 \log R_{P_{t-1}} + b_2 \log R_{X_{t-1}} + b_3 \log R_{P_{0_{t-1}}} + b_4 \log A_{t-1} + b_5 \log T + \log e. \]

13. \[ \log A_{t-1} = \log a + b_2 \log R_{P_{t-1}} + b_2 \log R_{X_{t-1}} + b_3 \log R_{P_{0_{t-1}}} + b_4 \log A_{t-1} + b_5 \log T + b_6 \log L_{t} + b_7 \log A_{t} + \log e. \]

14. \[ \log A_t = \log a + b_1 \log P_{t-1} + b_2 \log Y_{t-1} + b_3 \log T + \log e. \]

15. \[ \log A_t = \log a + b_1 \log P_{t-1} + b_2 \log Y_{t-1} + b_3 \log T + \log e. \]

16. \[ \log A_t = \log a + b_1 \log R_{P_{t-1}} + b_2 \log R_{X_{t-1}} + b_3 \log R_{P_{0_{t-1}}} + b_4 \log A_{t-1} + b_5 \log T + \log e. \]

17. \[ \log A_{t-1} = \log a + b_1 \log P_{t-2} + b_2 \log R_{P_{t-1}} + b_3 \log Y_{t-1} + b_4 \log R_{X_{t-1}} + b_5 \log R_{P_{0_{t-1}}} + b_6 \log A_{t-1} + b_7 \log T + \log e. \]
The models tried thus fall in five groups:

The first group of models, equations (1) to (4) includes only the traditional variables of own price and relative price with and without time trend variable.

The second group of models, equations (5) and (6) has one, two and three years lagged own prices with and without time trend as a variable.

In third group, equations (7), (8), (9), (10) and (11) lagged yield and production of own and relative crop with price represented as own price and relative prices are included with and without time trend variable.

In fourth group, equation (12) and (13) one year lagged area and current year irrigated area included along with other variables.

The fifth group, equations (14), (15), (16) and (17) is essentially in an attempt to test the impact of variability of revenue and per hectare revenue. On the equations already tried i.e., (1), (11), (12), and (13).

The procedure is to start with single variable. Least square regression, trying out the various alternative variables within each group and to pick out the last group of variables which explains the largest proportion of variation in the dependent variable.
It may be noted that the models tried differ in respect of the explanatory variables, the simplest is equation (1) where own absolute price is the only explanatory variable. The second equation adds a trend variable, $T$, to the first equation. The two equations are repeated again in equation (3) and (4) with explanatory variable now being the deflated price rather than the absolute price. The deflator used is the price of competing crop. equation (5) and (6) have only lagged prices as explanatory variables. Yield, relative yield, production and relative production variable are then added in equations (7), (8), (9), (10) and (11). Equations (12) and (13) add the lagged area and current irrigated area as explanatory variables. Finally equation 14, 15, 16 and 17 are an attempt to test the risk behaviour of farmers as presented by the relative variability of gross and per hectare revenue.

Cost of Production:

To estimate cost of production and input-output relationship of individual crop in this study, simple tabular analysis was carried out of the primary data collected from the sample farmers. Also, wherever desirable, simple statistical methods were used to derive the inferences from this study.