CHAPTER- III

RESEARCH DESIGN

To accomplish the objectives of the present study, data were obtained from the selected sample orchards in Punjab. The data, thus, pertained to the agricultural year 2001-02. The need and scope of the study, the sample selection, the method of data collection, and the analytical techniques used have been briefly discussed below.

3.1 Need of the Study

As has been discussed in the previous chapter, comprehensive studies have not been conducted in Punjab regarding the economics of cultivation of the major fruits and various constraints being faced by the fruit cultivators. Some attempts have been made but these restrict to a single fruit and that too kinnow. In addition, these studies have not been very recent and cannot provide the required information to succeed in an effort for diversification. Hence, such a holistic study becomes essential to facilitate the growth of horticultural sector in general and fruit crops in particular in Punjab. The present study aims at investigating the costs and returns, resource use as
well as the constraints faced by the cultivators for five major fruit
crops in the state.

3.2 Scope of the study

The present study has been undertaken on five major fruit
crops grown in Punjab, viz. kinnow, grapes, guava, mango and pear.
These fruits together contribute about two-third to the total area under
fruits in the state. The maximum area under kinnow orchards is in
Firozpur district, which accounts for 45.93 per cent of the total area
under the crop in the Punjab state. Grapes dominate in Bathinda
district, which has about 60.93 per cent of the total area under the
fruit in Punjab. Mango, guava and pear are concentrated more in
Hoshiarpur, Sangrur and Amritsar districts, and were being grown on
32.74, 18.22 and 61.51 per cent of the total area under these crops at
the time of sample selection i.e. 2001-02.
Table 3.1: District wise Cumulative Area Under Sample Fruits in Punjab, At the Time of Sample Selection.

<table>
<thead>
<tr>
<th>District</th>
<th>Kinnow</th>
<th>Grapes</th>
<th>Guava</th>
<th>Mango</th>
<th>Pear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gurdaspur</td>
<td>209</td>
<td>--</td>
<td>81</td>
<td>1323</td>
<td>52</td>
</tr>
<tr>
<td>Amritsar</td>
<td>91</td>
<td>3</td>
<td>432</td>
<td>225</td>
<td>1272</td>
</tr>
<tr>
<td>Kaurthala</td>
<td>17</td>
<td>4</td>
<td>63</td>
<td>40</td>
<td>24</td>
</tr>
<tr>
<td>Jalandhar</td>
<td>25</td>
<td>7</td>
<td>142</td>
<td>123</td>
<td>186</td>
</tr>
<tr>
<td>Nawanshehar</td>
<td>45</td>
<td>2</td>
<td>64</td>
<td>58</td>
<td>72</td>
</tr>
<tr>
<td>Hoshiarur</td>
<td>2320</td>
<td>2</td>
<td>171</td>
<td>1572</td>
<td>45</td>
</tr>
<tr>
<td>Rupnagar</td>
<td>369</td>
<td>2</td>
<td>216</td>
<td>609</td>
<td>23</td>
</tr>
<tr>
<td>Ludhiana</td>
<td>67</td>
<td>32</td>
<td>334</td>
<td>188</td>
<td>80</td>
</tr>
<tr>
<td>Firozpur</td>
<td>4563</td>
<td>171</td>
<td>253</td>
<td>--</td>
<td>58</td>
</tr>
<tr>
<td>Faridkot</td>
<td>145</td>
<td>35</td>
<td>141</td>
<td>--</td>
<td>15</td>
</tr>
<tr>
<td>Mukatsar</td>
<td>1471</td>
<td>114</td>
<td>172</td>
<td>9</td>
<td>69</td>
</tr>
<tr>
<td>Moga</td>
<td>7</td>
<td>7</td>
<td>48</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Bathinda</td>
<td>370</td>
<td>780</td>
<td>123</td>
<td>--</td>
<td>7</td>
</tr>
<tr>
<td>Mansa</td>
<td>87</td>
<td>--</td>
<td>59</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Sangrur</td>
<td>83</td>
<td>101</td>
<td>623</td>
<td>99</td>
<td>45</td>
</tr>
<tr>
<td>Patiala</td>
<td>55</td>
<td>14</td>
<td>404</td>
<td>427</td>
<td>100</td>
</tr>
<tr>
<td>Fatehgarh Sahib</td>
<td>9</td>
<td>6</td>
<td>92</td>
<td>127</td>
<td>20</td>
</tr>
</tbody>
</table>

Note: Data as on 31.03.2000.
Source: Director of Horticulture, Punjab.
It is evident from the Table 3.1 that the selected fruit crops i.e. kinnow, grapes, guava, mango and pear have the highest concentration in Firozpur, Bathinda, Sangrur, Hoshiarpur and Amritsar districts respectively. It was not possible to study the economics of fruit cultivation in whole of Punjab because of skewed climatic conditions conducive for the production of these specific crops in particular regions of the State. Hence, the scope of the study has been confined to these five districts and five fruits only.

3.3 Objectives of the Study

The following objectives have been focused upon in the present study:

1. To study the cost of production of major fruits of Punjab and, the returns from each of the fruit crops.

2. To evaluate the economic rationale of resource use.

3. To find out the problems of farmers producing fruit crops in Punjab and suggestions thereof.

3.4 Research Methodology

The present study is primarily based on both primary and secondary data.
3.4.1 **Sources of Secondary Data**

The secondary information regarding area and production of fruit crops was obtained from Director of Horticulture, Punjab whereas the data on exports were collected from the official publications of Agricultural Products Export Promotion Corporation (APEDA). An attempt has been made to see the changes in area and production of different fruit crops in Punjab from 1985-86 to 1998-99. After 1998-99, the estimates of area and production were revised based on the actual census. These estimates are entirely different (and are on the lower side) from the estimates before 1999-2000. Hence, the analysis has been restricted to the period 1985-86 to 1998-99 (for which the information regarding both area and production were available).

3.4.2 **Tools and Techniques Used for Secondary Data**

The compound growth rates for area, production and export of fruits have been worked out by fitting the following exponential function:

\[ Y = AB^t \]

\( Y = \text{Area/Production/Export} \)
\( t = \text{Time in years } (t=1,2,3,\ldots) \)
\( A = \text{Constant} \)
B = Coefficient of regression

Further,

\[ B = 1 + r \]

where ‘r’ is the compound growth rate.

Therefore, \( r = (B-1) \times 100 \)

Standard error of compound growth rates was computed by using the following formula:

\[ SE(r) = \frac{100B}{\log_{10} A} = SE \log_{10} B \]

Student ‘t’ test has been applied to examine the significance of growth rates by using the formula:

\[ t = \frac{r}{SE(r)} \]

### 3.4.3 Primary Data

The primary data were collected with the help of a specially designed pre-tested questionnaire. The questionnaire was administered personally to the sample farmers to collect information on the farm resources, cropping system, cost of cultivation and production of crops and fruits. The data on output and its price for fruit crops raised on sample orchards for the agricultural year 2001-
were obtained. In addition, information pertaining to various problems in production and marketing was also collected.

3.4.4 **Sampling Design for Primary Data**

Stratified random sampling technique was used for the selection of sample. At the first stage of sampling, one district was selected for each of the five fruit crops under study. The district was selected on the basis of maximum area under a particular fruit crop in the state, hence, Firozpur for kinnow, Bathinda for grapes, Sangrur for guava, Hoshiarpur for mango and Amritsar for pear were selected.

At the second stage, two blocks were selected randomly for each fruit crop in the selected district. At the third stage, two village clusters from each block were selected randomly. The village clusters were selected to ensure sufficient number of fruit orchards for selecting the sample. Finally, a sample of thirty orchardists was selected from the four village clusters under each fruit crop. In all, 150 fruit orchards were selected for the study i.e. 30 orchards for each fruit crop. The details of the districts, blocks and the number of cultivating households are given below:
<table>
<thead>
<tr>
<th>Fruit Crop</th>
<th>District Selected</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Kinnow</td>
<td>Firozpur</td>
<td>30</td>
</tr>
<tr>
<td>2. Grapes</td>
<td>Bathinda</td>
<td>30</td>
</tr>
<tr>
<td>3. Guava</td>
<td>Sangrur</td>
<td>30</td>
</tr>
<tr>
<td>4. Mango</td>
<td>Hoshiarpur</td>
<td>30</td>
</tr>
<tr>
<td>5. Pear</td>
<td>Amritsar</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total Sample Size</strong></td>
<td></td>
<td><strong>150</strong></td>
</tr>
</tbody>
</table>

### 3.4.5 Tools and Techniques Used for Primary Data

Various mathematical and statistical techniques have been used for analyzing the primary data collected for the sample fruits through well-designed questionnaires. These have been discussed in detail in the ensuing sections.

#### 3.4.5.1 Definition of Parameters Used

**Economic Life of Trees:**

Average economic life of a tree coincides with the bearing life of the tree but it is considered for the period at which the tree gives fruits equal to the value/cost of maintenance of the plant. Generally, a fruit tree starts bearing fruits at an early age and continues to bear fruits at an old age too but the value of these fruits does not even cover the
variable costs. Therefore, the economic life of a tree is considered for the period in which tree gives economic returns. In this study, only those orchards were selected which were bearing the fruits economically and all the non-economic fruit orchards were excluded.

**Bearing Tree:**

A tree of bearing age is defined as a tree which has attained the specified age irrespective of the fact whether it bore fruit or not, during a particular year. This age is taken to be about six, three, four, seven and seven years in case of kinnow, grapes, guava, mango and pear respectively after planting of trees.

**Varieties of Fruit Crops:**

The varieties being grown by the fruit cultivators in the study area are *Kinnow* for citrus, *Perlette* for grapes, *Allahabad Sufeda* for guava, *Dussehri* for mango and *Patharnakh for Pear*.

**Orchard:**

An area of at least half an acre under fruits and owned by a person is defined as an orchard in the present study.
**Orchardist:**

Any person owning an orchard is defined to be an orchardist. In the present study, various terms such as orchardist, grower, farmer, farm and household have been used synonymously.

**Farm:**

A piece of owned or operated land on which fruits and/or other crops are grown and which is under a single management unit is called a farm.

**Household:**

An individual person or group of persons living together as a single unit is called household.

**Pre-harvest Contractor:**

A pre-harvest contractor is one who buys the standing crop from the growers i.e. they buy the crop before its harvest and undertake to perform all the operations including the picking and other marketing functions at their own risk and cost. A pre-harvest contractor usually buys the crop at a relatively lower price and earns
profits in lieu of higher risk transferred to him from the orchardist during the marketing of crops.

**Establishment Cost:**

All the costs incurred by the orchardists for preparation of land upto planting, seedlings and fencing of the orchard is called establishment cost of orchard. It also includes all other costs incurred until the orchard starts bearing economically.

**Maintenance Cost:**

The cost incurred on maintenance of the orchard year after year after it starts bearing economically is known as maintenance cost.

3.4.5.2 **Quantification of the Variables**

The most limiting resources in the production of different fruit crops in the study area were identified as under:

**Production:**

The production has been defined as the gross value of the output of the fruit crop in money terms evaluated by multiplying the
physical quantities by respective prices in the reference year.

**Number of Trees:**

The number of trees was an input being operated per orchard.

**Human Labour:**

Human labour used on the selected orchards comprised family labour, attached farm servant, exchange labour and hired human labour. The child and woman labour input was converted into adult man unit by considering a labour hour put in by a child as equivalent to 0.5 adult man hour and that put by a woman as equivalent to 0.67 adult man hour. The human labour employed to perform different farm operations on the sample farm was, thus, considered in adult man-hours.

**Manures and Fertilisers:**

Expenditure on manures and fertilizers has been evaluated by multiplying the physical quantities of different manure and fertilizers used on the orchard with their respective prices.
**Fungicides and Insecticides:**

Expenditure on fungicides and insecticides has been evaluated by multiplying the physical quantities of different fungicides and insecticides used on the orchard with their respective prices.

**Fixed Capital:**

Fixed capital includes annual depreciation on farm implements and machinery, farm buildings and interest in terms of money value.

**Establishment and Maintenance Cost:**

Establishment and maintenance cost has been defined as the cost incurred by the orchardists in establishing the orchard (excluding the value of land) and maintaining the plantations.

### 3.4.5.3 Tabular Analysis

The tabular analysis was done to study the socio-economic profile of the sample orchardists as well as various problems faced by them in Punjab. Simple percentages and averages were also computed to study these aspects of fruit cultivation.
3.4.5.4 Ratio of Gross Returns to Variable Costs

The net returns over variable costs have been calculated as the difference between the gross return and the cost. The ratios of gross returns to variable costs indicate the profitability of the enterprise.

3.4.5.5 Production Function

To examine the allocative efficiency of resources in fruit orchards under study, the Cobb Douglas production function was adopted. This function has been logically appropriate because of the smaller number of degrees of freedom involved in estimating the parameters. Cobb Douglas production function provides an adequate fit and has assisted in the estimation of marginal value product. The algebraic form of the function is:

\[ Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} \]

In the log form it becomes

\[ \log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 \]

where \( Y \) = Production of fruits in rupees

\( X_1 \) = Expenditure on farm yard manure and chemical fertilizers

\( X_2 \) = Expenditure on plant protection chemicals

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\[ X_3 = \text{Expenditure on irrigation} \]
\[ X_4 = \text{Expenditure on human labour} \]
\[ a = \text{intercept, and} \]
\[ b_1 \text{ to } b_4 \text{ are the elasticity coefficients.} \]

### 3.4.5.6 Resource Use Efficiency

The resource use efficiency was judged on the basis of marginal value productivity (MVP), which indicated the increase in the gross return from the use of an additional unit of a given input while keeping the level of other inputs constant. The marginal value productivity of the \( i \)-th input was measured by using the following formula:

\[
\text{MVP} = b_i \left( \frac{\bar{Y}}{\bar{X}_i} \right) P_y
\]

where, \( \bar{Y} \) = Geometric mean of yield of fruit per hectare.
\[ \bar{X}_i = \text{Geometric mean level of } i\text{-th resource.} \]
\[ b_i = \text{Production elasticity of } i\text{-th input.} \]
\[ P_y = \text{Price of the product.} \]

The resource use efficiency was studied by comparing the MVPs of each resource with corresponding factor costs at which that resource could be procured.
3.5 Limitations of the Study

The extent of the study was confined to some limits such as selection of fruits, area under study, size of sample, etc. keeping in mind certain constraints, which were identifiable before hand. These limitations were in the form of time, finance and certain other technicalities. It was also observed that many a times farmers were hesitant in giving answers to very significant questions regarding income, size of land, etc. and hence were to be cross-checked at various stages. Moreover, majority of the orchardists were not in the habit of maintaining proper record of inputs and outputs. The absence of proper records and lack of authentic information regarding the past crops made the cross-sectional analysis impossible and thus was not undertaken.