It has been mentioned in the previous chapter that there is a lack systematic record of data on Basmati. Therefore, this study mainly relies on primary survey. However, some scanty secondary information is available and this has been compiled. The present chapter outlines the sources of data and primary survey sampling design, along with the methodologies used, with special emphasis given to methodologies used for estimating cost of crop cultivation. This chapter has been organised into three sections namely database, methodology and concepts and definitions.

2.1. Data Base

2.1.1. Primary Sources of Data

To look into the various issues at farmers’ level a field survey was carried out in the selected Basmati growing areas in India during the agricultural year 2003-04. Among the states, farmers in Uttar Pradesh and Uttarakhal are shifting area under Basmati to sugarcane cultivation because of better yields. Further, in Uttar Pradesh a Non-Basmati variety named ‘Sharbati’ has become popular in the last few years primarily because of its short duration and higher yields. The exportable quality of Basmati is grown mostly in Punjab and Haryana. Thus, only these two states have been considered for field surveys.

In Punjab the major rice growing districts are Amritsar, Gurdaspur, Ludhiana, Ferozpur, Sangrur, Patiala, Jalandhar, Kapurthala, Faridkot, and Hoshiarpur. Among these districts the under rice in Amritsar and Gurdaspur was 12.29 and 7.47 per cent respectively in the year 2002 (Appendix Table A-I). Further, both these districts are the traditional Basmati growing districts. Therefore, in Punjab the districts of Amritsar and Gurdaspur were selected for conducting the field survey.

In Haryana, major rice growing districts include Karnal, Kurukshetra, Kaithal, Ambala, Jind, Panipat, Sonipat, and Yamunanagar. Among these districts the area under rice in Karnal and Panipat was 17.57 and 7.07 per cent respectively in the year 2002 (Appendix Table A-I). Among these districts, a part of Karnal called Taraori is well known for Basmati. Discussions with the Office of the Deputy Director

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3 Information received from SCS-Group an agri-business firm based in Gurgaon.
Agriculture, District Statistical Officer, Karnal and APEDA officials revealed that the cultivation of Pusa Basmati (a hybrid variety) is predominant in Panipat. Therefore, in Haryana the districts Panipat and Karnal were chosen for conducting field survey. Thus, in total four districts were considered for drawing sample of farm households (See maps).
Chapter 2: Database and Methodology
Map 2.4 : District Map of Amritsar

Chapter 2: Database and Methodology
Map 2.5: District Map of Gurdaspur
Chapter 2: Database and Methodology
Chapter 2: Database and Methodology
2.1.1.1. **Physiographical Setting of Sample Districts**

**Amritsar**: It is bounded by Pakistan on the West and South West, Gurdaspur district in the North and North East, Kapurthala district in the East South East and Ferozepur district in the South-South East. It is situated in the north-western part of the State in the Bari Doab, a territory situated between Beas and Ravi rivers. Amritsar district has an area of 5,087.00 sq.km. Amritsar district comprises five tehsils viz., Ajnala, Amritsar, Baba Bakala, Tarn Taran and Patti. Further, the district is sub-divided into following 15 community development blocks: (1) Verka, (2) Majitha (3) Jandiala (in Amritsar tehsil), (4) Tarsikka, (5) Rayya (in Baba Bakala tehsil), (6) Patti, (7) Bhikhiwind, (8) Valtoha (in patti tehsil), (9) Tarn Taran, (10) Khadur Sahib, (11) Gaddiwind, (12) Naushhehra Pannuan, (13) Chola Sahib (in Tarn Taran tehsil), (14) Ajnala and (15) Chogawan (in Ajnala tehsil).

The climate of Amritsar district is characterized by general dryness, except during the brief south-west monsoon, a hot summer and a bracing winter. The amount of rainfall received increases generally from the south-west towards the north-east. About 74 per cent of the annual normal rainfall is received during the period June to September and as much as 18 per cent of the annual rainfall occurs during the period December to February. However, there is variation of rainfall from year to year.

Lying between the Beas river to the east and the Ravi river to the west, Amritsar district, forms the lower part of the Upper Bari Doab, which is one of the interfluvial tracts of the Punjab Plain. The Beas river, which separates the Amritsar district from Kapurthala district, joins the Sutlej river near the point where the three districts of Firozpur, Amritsar and Kapurthala meet. The existing soil is a light reddish-yellow loam, known to the people as 'maira', but its stiffens into 'rohi' or clay, in which the surface drainage collects on its way down the doab from the hills, and occasionally degenerates into strips of sandy, slightly uneven soil, locally known as 'tibba', bare of trees and apt to be blown into hummocks by the wind. The Amritsar district is a continuous level plain, unbroken by hills or valleys. It ranges in its elevation from about 200 metres in the north-east to about 175 meters in the south-west. Thus, the slope of the land stretches from north-east to south-west, with a gentle gradient of one metre in four kilometres. It points out that the district has a flat topography in general.
Gurdaspur: It is the northern most district of the state of Punjab. It is located between north latitude 310-360 and 320-340 and east longitude 740-560 and 750-240 and shares common boundaries with Kathua district of Jammu and Kashmir in the north, Chamba and Kangra district of Himachal Pradesh in the north-east, Hoshiarpur district in the south-east, Kapurthala district in the south, Amritsar district in the south-west and Pakistan in the north west. The district has an area of 3,562.0 sq. km. The tehsils in Gurdaspur district include Pathankot, Gurdaspur and Batala. Further, the district is sub-divided into 13 Community Development Blocks viz., Bamial, Narot Jaimal Singh, Pathankot, Dhar Kalan (in Pathankot tehsil), Dhariwal, Dinanagar, Gurdaspur, Kahnuwan, Kalanaur (in Gurdaspur tehsil), Batala, Dera Baba Nanak, Fatehgarh Churain and Sri Hargobindpur (in Batala tehsil).

The climate of the district is somewhat milder than that of the neighbouring districts to the south. During summer, on individual days, day temperature in the plains reaches over 440°C. The hilly regions are comparatively cooler. About 70 per cent of the annual rainfall in the district is received during the period July to September. However, some pre-monsoon showers are experienced in June. The winter rains are experienced during January- February due to western disturbances. Occasional fogs occur in the winter season. The dust storms occur in latter part of the summer months, generally May and June. A large part of the district is plain but its northern most part in Pathankot tehsil is hilly and situated in the Shiwalik Hills. There are two main rivers viz. Beas and Ravi, which originate from Himachal Pradesh territory.

Karnal: It is bounded by the districts of Kurukshetra and Yamunanagar in north, Panipat in south, Kaithal in west and State of Uttar Pradesh in the east. Karnal district experiences sub-tropical continental monsoon climate, which is characterised by seasonal rhythm, hot summer, cool winter, unreliable rainfall and great variations in temperature. The rainfall distribution is relatively even in the western parts of Haryana. Though Karnal receives most of the rainfall during monsoon season, yet some rain is received during the winter season. Air is generally dry during the greater part of the year. Dust storms mostly occur during April to June. Dense fog dense occurs for a brief period in the winter season. Thunderstorms also occur in winter season along with cyclones.

Chapter 2: Database and Methodology
The district is a plain area, which slopes from northeast to south and southwest. The plain is a flat and within it, there is a narrow low-lying flood-plain area known as ‘khadar’ of Yamuna river. The upland of Karnal district is known as ‘bhangar’ containing old alluvium. Yamuna is a perennial river that makes the eastern boundary of the district. The district has a good network of canals. Underground water level is comparatively high. Tubewell irrigation is also common in the district. West of the ‘bhangar’ tract is the ‘nardak’ where water table is relatively deep. Mostly, the soils are loam (bhangar and nardak) and salty loam (khadar) types.

Panipat: Panipat district is bounded by the districts of Kaithal and Karnal in north, Sonipat and Rohtak in south, Jind in west and State of Uttar Pradesh in east. The physiological and climatic characteristics of Panipat district are similar to Karnal. The district is not rich in its forest wealth. Tropical Dry Deciduous Forests are found here.

It is to be noted that amongst all districts of Punjab and Haryana, the districts selected for the field survey i.e., the districts wherein Basmati is mostly cultivated have a larger share of utilizable ground water resources (Table 2.1). This shows that Basmati requires comparatively less irrigation than Non-Basmati. An exception however, is the district of Panipat, wherein farmers are increasing devoting their areas towards the cultivation of a hybrid Basmati variety (a cross of Basmati and Non-Basmati variety) named ‘Pusa Basmati’.

Table 2.1: Utilisable Ground Water Resources in Districts of Punjab and Haryana (Mcm)

<table>
<thead>
<tr>
<th>Punjab Districts</th>
<th>Utilizable Ground Water Resources</th>
<th>Haryana Districts</th>
<th>Utilizable Ground Water Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amritsar</td>
<td>1522</td>
<td>Ambala</td>
<td>524</td>
</tr>
<tr>
<td>Bathinda</td>
<td>474</td>
<td>Bhiwani</td>
<td>826</td>
</tr>
<tr>
<td>Faridkot</td>
<td>501</td>
<td>Panchkula</td>
<td>133</td>
</tr>
<tr>
<td>Fatehgarh Sahib</td>
<td>363</td>
<td>Yamunanagar</td>
<td>758</td>
</tr>
<tr>
<td>Firozpur</td>
<td>2260</td>
<td>Kurukshetra</td>
<td>505</td>
</tr>
<tr>
<td>Gurgaonpur</td>
<td>1458</td>
<td>Kaithal</td>
<td>870</td>
</tr>
<tr>
<td>Hoshiarpur</td>
<td>919</td>
<td>Karnal</td>
<td>1094</td>
</tr>
<tr>
<td>Jalandhar</td>
<td>612</td>
<td>Panipat</td>
<td>514</td>
</tr>
<tr>
<td>Kapurthala</td>
<td>306</td>
<td>Sonepat</td>
<td>826</td>
</tr>
<tr>
<td>Ludhiana</td>
<td>1416</td>
<td>Rohtak</td>
<td>578</td>
</tr>
<tr>
<td>Mansa</td>
<td>694</td>
<td>Jhajjar</td>
<td>703</td>
</tr>
<tr>
<td>Moga</td>
<td>713</td>
<td>Gurgaon</td>
<td>718</td>
</tr>
<tr>
<td>Muktsar</td>
<td>960</td>
<td>Faridabad</td>
<td>760</td>
</tr>
<tr>
<td>Nawin Shehar</td>
<td>374</td>
<td>Rewari</td>
<td>393</td>
</tr>
<tr>
<td>Patiala</td>
<td>1101</td>
<td>Mahendragarh</td>
<td>193</td>
</tr>
<tr>
<td>Sangrur</td>
<td>1290</td>
<td>Hissar</td>
<td>1021</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patchabhad</td>
<td>777</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sirsa</td>
<td>922</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jind</td>
<td>971</td>
</tr>
</tbody>
</table>

2.1.1.2. Sampling Design and Study Area

The present study is based on a survey of a cross section of cultivating households in selected districts of Punjab and Haryana. The field study was undertaken for the agricultural year 2003-04. Initially a pilot field survey was conducted. Based on the results of that survey, a detailed schedule was prepared for the collection of primary data. Personal investigation method of field survey with schedules canvassing to farmers was followed. Two-stage sampling procedure was adopted to draw the samples with village being the first stage sampling unit and farm households being the second stage unit. The steps involved in sampling procedure are broadly outlined below.

Selection of Villages

Based on the information gathered through a pilot survey, major Basmati growing blocks in the selected districts of Punjab and Haryana were identified. Consultations were also held with Officials of Directorate of Agriculture of Punjab and Haryana and Agriculture and Processed Food Exports Development Authority (APEDA) to utilise their experience in identifying the major areas of Basmati cultivation. Data and other information gathered through pilot survey and views of Government Officials had helped to prepare the list of blocks and villages for conducting the survey. Accordingly, two blocks were selected from each district. Then, one village was selected from each block through purposive random sampling procedure. In total eight villages were selected for drawing the sample of farm households (Table 2.2). The Table 2.2 and Map 2.4, Map 2.5, Map 2.6 and Map 2.7 show the selected villages from each district and block in both the states.

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4 Purposive random sampling is a method of sampling in which the investigator makes choice of the samples which in his opinion are best representative of the universe. In the present study the Basmati sample villages have been selected based on the advice of the Directorate of Agriculture, block and tehsil officials as well as information gathered through pilot surveys.
Table 2.2: Name of Blocks and Villages Selected for Primary Survey

<table>
<thead>
<tr>
<th>Districts</th>
<th>Blocks</th>
<th>Villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUNJAB STATE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amritsar</td>
<td>Verka</td>
<td>Chabba</td>
</tr>
<tr>
<td>Gurdaspur</td>
<td>Taran Tarn</td>
<td>Golver</td>
</tr>
<tr>
<td></td>
<td>Fatehgarh Churian</td>
<td>Dadujodh</td>
</tr>
<tr>
<td></td>
<td>Gurdaspur</td>
<td>Dorangla</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HARYANA STATE</th>
<th>Blocks</th>
<th>Villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karnal</td>
<td>Nilokheri</td>
<td>Pakhana</td>
</tr>
<tr>
<td>Panipat</td>
<td>Nissing</td>
<td>(Taraori)</td>
</tr>
<tr>
<td></td>
<td>Assandh</td>
<td>Shambhli</td>
</tr>
<tr>
<td></td>
<td>Madlauda</td>
<td>Dadlana</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bhalși</td>
</tr>
</tbody>
</table>

Source: Primary Field Survey

Selection of Sample Households

Before the selection of farm households, they were enlisted along with various information including operational holdings i.e., net cultivated area (NCA) in the selected eight villages. Based on the net cultivated area, farm households were categorized into three broad sub-classes viz., small (upto 5 acre), medium (5.01 to 25 acre) and large (above 25 acre). Within sub-classes, the households were selected based on proportionate random sampling procedure. Accordingly, forty households were selected from each village. Thus, making total sample size of 160 each in Punjab and Haryana. Following this, systematic random sampling method was adopted for the selection of sample households.

Under systematic random sampling method, firstly all farm households in a village were enumerated. The next step was to find the random interval. This was calculated by dividing the total number of households in particular category (For e.g. \( n = 100 \)) in the village by the number of households that are to be selected (e.g. \( n = 20 \)). Thus, the random interval is equal to \( 100/20 = 5 \). Then the first household was selected using the random numbers table. Subsequently every 5\(^{th}\) household from the total number of households was taken to frame a sample. Therefore, if the first selected number was the 5\(^{th}\) household from the total number of households was taken to frame a sample. Therefore, if the first selected number was the 5\(^{th}\) household, then the subsequent selected households were the 15\(^{th}\), 25\(^{th}\), 35\(^{th}\), 45\(^{th}\), and so on. When the random interval was in decimals, it was converted to the next whole number. However, if a sample household could not be surveyed due to any reason, then the sampling household with the next sampling serial number was substituted for collecting information. Farmers were interviewed by using pre-tested structured schedules (Appendix H).

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Further, information regarding the marketing channel adopted by Basmati farmers was also taken from intermediaries, a few major export houses and grain markets (mandis) near Amritsar and Karnal. Time series data on domestic wholesale prices of paddy and paddy market arrivals was collected from few selected grain markets of Punjab and Haryana. Grain markets in Punjab selected were Amritsar, Tarn Taran, Fatehgarh Churian, Gurdaspur and those selected in Haryana were Taraori, Karnal, Gharaunda, Madlauda. The month wise farm harvest prices of Basmati paddy was collected from the Karnal grain mandi records.

2.1.2. Secondary Sources of Data

There is a lack of systematic official statistics on Basmati rice cultivation in India. Time series data on production, area and yield are not available. However, various national and international sources provide some information on international trade in Basmati rice. These included Export Statistics for Agriculture and Food Products published by APEDA, FAO Trade Yearbook, Director General of Commercial Intelligence and Statistics (DGCIS) and Centre for Monitoring India Economy (CMIE). These sources provide time-series data on rice exports, international markets and prices. Further, data on India’s agriculture and allied activities were compiled from various issues of Economic Survey. Data on domestic price of Basmati rice were collected from Economic Times newspaper.

Lack of relevant statistical data for Pakistan also poses problems in examining the comparison of Pakistan’s competitiveness of Basmati rice with that of India. However, the required information has been gauged from various reliable websites such as www.oryza.com, www.statpak.gov.pk (website of the Federal Bureau of Statistics of Pakistan) and APEDA, Government of India.

2.2. Concepts and Definitions

It is important to define various concepts and terms used in the study for better understanding and clarity. Brief descriptions of the important concepts have been given below.

1. Household: Household is basic unit used both for the purpose of sampling and analysis. It is basically a unit in which all family members are under joint operation for their livelihood. Some members might be engaged in farming activities while some others might be in non-farming activities, but there is a
single decision making body for the household. A household shares a common kitchen and members live together under the same roof for not less than six months during the reference period. For the household to be a cultivating household, it need not own but must operate some land.

2. **Net Cultivated Area (NCA):** It refers to the size of operational holdings of the household. It comprises land owned minus uncultivated land plus land leased in minus land leased out.

3. **Dependency Ratio:** It is the ratio of the economically dependent part of the population, to the productive part. The economically dependent part is recognised to be children who are too young to work, and individuals who are too old. That is, it includes individuals under the age of 15 and over the age of 60. The productive population comprises the age group of 15 to 59. The dependency ratio is important for analysis from the fact that as the ratio increases, there is increased strain on the productive part of the population to support the economically dependent. There are also direct impacts on financial elements like social security.

4. **Gross Output:** It is the sum of the value of main products of all the crops and their by-products in the form of straw, stalks, culms etc. The value of gross output has been estimated for all crops at actual prices received by the farmers at the time of selling. For those items which are not sold in the market, their prices prevailing in the village were used for calculating total value.

5. **Total Costs:** These include the value of different intermediate and primary inputs used in the production of different crops. Total costs comprise variable and fixed costs. These costs have been derived from the actual paid-out costs of the farmers as well as imputed costs. Total costs have also been apportioned to impute value for certain items. (Table 2.3 and Table 2.4)

6. **Biochemical Inputs:** This is a composite input and includes expenditure on farm manure, fertilizer, insecticides and pesticides, irrigation and seed. Total cost of these inputs is used as a single variable in the regression analysis as it takes care of the problems of multicollinearity resulting from high correlation between irrigation and fertilizers.

7. **Farm Business Income (FBY):** It is obtained by subtracting the total cost C2 from the gross value of farm output. Therefore;

   \[
   \text{Farm Business Income} = \text{Gross Output/Returns} - \text{Total Cost C2}.
   \]
8. **Net Household Income (NHY):** This is equal to the **Farm Business Income + Income from Milk Sales + Income from Subsidiary Occupations + Income from Land Leased Out + Income from Farm Implements Leased Out.** The net household income does not include gifts or dowry in any form.

9. **Marketed Surplus:** It is the quantity of produce that the producer actually sells irrespective of his needs for home consumption and other requirements. Thus, it may indicate distress sales which are undertaken by farmers under pressure of immediate cash needs. The farmer may have to repurchase some of the same product from the market to meet his needs.

10. **Marketing Channels:** These are routes through which agricultural products move from producers to consumers.

11. **Price Spread:** It is the difference between the prices received by the producer and that paid by consumers. This difference represents the cost of marketing, which in turn determines the producers’ share in the consumers’ price.

12. **Contract Farming:** It refers to an agreement between the farmer-producers and agri-business firms to produce certain pre agreed quantity and quality of the crop produce at a particular price and time. It can either be procurement or can extend to the supply of inputs by the agri-business firms to the farmer-producers.

2.3. **Methodology**

Various mathematical and statistical techniques were used to analyse data and to interpret results properly. These tools included Percentages, Tabular and Graphical analysis, Dependency Ratio, Standard Deviation, Coefficient of Variation, Trend Growth Rates using Semi-log function, Lorenz curves and Gini’s coefficients, Cobb-Douglas production function, Regressions, Correlations and Tests of Significance.

2.3.1. **Lorenz Curve and Gini’s Coefficient**

This curve was first used by Max Lorenz and is a graphical representation of inequality and is a widely used device for analyzing income and wealth inequality. In this study the x-axis of the Lorenz curve includes values of cumulative percentage of households and y-axis includes values of cumulative percentage of per capita incomes, output and area. For complete equality of income the Lorenz curve would be a straight line; it becomes more curved as inequality increases. The Gini’s coefficient...
is the measure of this inequality. It is the ratio of the area between the diagonal and the Lorenz curve to the total area under the diagonal. It is expressed as;

\[ \text{Gini's Coefficient} = \left( (X_i \cdot Y_{i+1}) - (X_{i+1} \cdot Y_i) \right) \]

Where,

- \( X_i \) is cumulative percentage of households
- \( Y_i \) is the cumulative percentage of per capita incomes, output and area
- \( (X_{i+1}) \) is cumulative percentage of households lag one
- \( (Y_{i+1}) \) is cumulative percentage of per capita incomes, output and area lag one

The larger the value of the Gini’s coefficient or the closer the coefficient value to unity i.e., one, the greater is the inequality.

2.3.2. Cost of Cultivation

To understand the economics of Basmati production, an analysis of Cost of Cultivation was undertaken. Data collected through field survey has been used extensively for the detailed analysis. The present study follows the methodology adopted by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India in its annual report ‘Comprehensive Scheme for Studying the Cost of Cultivation of Principle Crops in India’. The reports on cost of cultivation studies conducted during the fifties and sixties have also been made use of in the present study. The details of method used to estimate cost of cultivation are provided in Table 2.3 and Table 2.4.

The costs have been estimated at three levels viz., actual costs, imputed costs and joint costs. Actual costs are based on the actual market rates prevailing in the village at the time of the field survey. These include casual or hired labour charges for specific farm operations, wages of attached human labour, electricity and mobil oil costs for irrigation, tractor diesel costs, hired machinery rents, repairs of implements, costs of seeds, fertilizers, insecticides and pesticides and growth regulators, leased in land rents and canal taxes.

Imputed costs are assigned to those inputs used in production process that come from family sources. These include the value assigned to family labour, rent of owned land, kind payments, farm saved and exchanged seeds, and depreciation of farm buildings and implements.

Joint costs are the expenditure incurred on or imputed for, some of the cost items that relate to the farm as a whole. Such joint costs are allocated or apportioned
to individual crops. In this study, the joint costs which have been apportioned to individual crops are depreciation on farm buildings and implements, land rents, canal taxes, electricity and mobil oil costs for irrigation, repairs of implements, interest on owned fixed capital and wages of attached human labour.
<table>
<thead>
<tr>
<th>Cost Categories</th>
<th>Operational Costs</th>
<th>Joint Costs (Costs Apportioned)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Human Labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casual Labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attached Labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B Machine Labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hired Machinery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owned Machinery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C Seed Cost</td>
<td>Purchased</td>
<td>Farm saved or Exchanged</td>
</tr>
<tr>
<td>D Fertilizer Cost</td>
<td>Purchased</td>
<td></td>
</tr>
<tr>
<td>E Insecticide &amp; Pesticide Cost</td>
<td>Purchased</td>
<td></td>
</tr>
<tr>
<td>F Growth Regulators Cost</td>
<td>Purchased</td>
<td></td>
</tr>
<tr>
<td>G Irrigation Charges</td>
<td></td>
<td>Electricity Charges and Mobil Oil Costs for Tubewell and Pumpsets</td>
</tr>
<tr>
<td>H Total Working Capital (A+B+C+D+E+F+G)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I Interest on Working Capital @ 12.5% per annum for 4 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J Total Variable Cost (H+I)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continued...
FIXED COSTS

<table>
<thead>
<tr>
<th>Cost Categories</th>
<th>Actual Paid Out Costs</th>
<th>Imputed Costs</th>
<th>Costs Apportioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Land Rent</td>
<td>(a) Rent of Leased In land</td>
<td>(b) Rent of Owned Land</td>
<td>Total Rent (a + b)</td>
</tr>
<tr>
<td>b Taxes</td>
<td>(Canal Fees Paid to Government)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c Depreciation of Fixed Farm Assets</td>
<td></td>
<td>Depreciation (Straight Line Method)</td>
<td></td>
</tr>
<tr>
<td>d Fixed Cost</td>
<td>(a+b+c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e Interest on Fixed Capital @ 10% for 6 Months</td>
<td>Interest on Fixed Capital @ 10% per annum for 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f Total Fixed Cost</td>
<td>(d+e)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The canal charges paid to the government have been included in the item “Land revenues, cesses and taxes” in paper titled ‘Cost of Production of Paddy in Andhra Pradesh during 1971-72’ by the Ministry of Agriculture, in Agricultural Situation in India, August 1974)*

Farmers pay casual or hired labour charges on per acre basis for carrying out farm operations like sowing, harvesting and threshing. But, for operations like weeding (manual removal of weeds and spraying weedicides), pesticide spraying and fertilizer application, the casual labours are paid on the basis of mandays per acre. The mandays per acre was then multiplied with the average wage rate per person per day for calculating cost of a particular farm operation. This exercise has been done separately across different farm size groups.

Family labour has not only been involved in farm operations but they also supervised farm operations where hired labour was being used. Costs of supervision by family labour have not been considered. Family labour has been involved in operations especially application of weedicides, pesticides and fertilizers. The cost of family labour engaged in such operations has been computed based on the actual casual wage rate or the market rate reported by farmers. The family mandays per acre was multiplied with the average wage rate per person per day for computing cost of a particular farm operation. This exercise has also been done separately for small, medium and large farmers.

During the survey it was found that in Punjab farm servants or attached human labour was also involved in farming operations and tending to cattle (maintaining cattle sheds, feeding and milching cows etc). Their wages were paid in both cash and kind. The kind payments were converted into value terms at prices
prevalent in the village at the time such payments were made. Thereby, attached labour cost per farm has been apportioned to each crop by using the following formula:

\[
\text{Cost of attached human labour per acre for each crop} = \frac{\text{Gross output from each crop}}{\text{Gross output from all crops and milk sale revenues}} \times \text{Attached labour wages for the year}
\]

Hired machinery costs include rents of tractor, combine harvester, combine thresher and spray pumps used for the application of weedicides and pesticides. Cost of owned machinery includes tractor diesel charges as well as charges on account of repairs and maintenance of owned farm assets. Implement repair costs have been apportioned as follows:

\[
\text{Implement repair costs per acre for each crop} = \frac{\text{Area under each crop}}{\text{Gross cropped area}} \times \text{Total implement repair costs for the year}
\]

Cost of seeds whether purchased or farm saved/ exchanged have been estimated based on the actual market rate of seeds. Similarly, costs of fertilizers, insecticides and pesticides and growth regulators have been estimated on the basis of their respective market rates.

For calculating cost of irrigation, the electricity charges in case of tube well irrigation and mobil oil costs in case of oil engines and pumpsets were used. It was apportioned as follows:

\[
\text{Cost of electricity and mobil oil for irrigation per acre for each crop} = \frac{\text{Number of irrigation to each crop} \times \text{Area under each crop}}{\text{Number of irrigation to all crops} \times \text{Area of all crops}} \times \text{Electricity bill & mobil oil charges for the year}
\]
Land rent for leased in as well as owned land has been apportioned as follows:

\[
\text{Land rent per acre for each crop} = \frac{\text{Area under each crop}}{\text{Gross cropped area}} \times \text{Land rent for the year}
\]

The rent of owned land has been estimated on the basis of prevailing leased in land rents in the village as reported by the farmers.

Taxes include canal fees paid to the government by the farmers. The canal charges paid to the government have been included in the item 'Land revenues, cesses and taxes' (Cost of Production of Paddy in Andhra Pradesh during 1971-72, Agricultural Situation in India, August 1974). Total taxes have been apportioned as follows:

\[
\text{Canal taxes per acre for each crop} = \frac{\text{Area under each crop}}{\text{Gross cropped area}} \times \text{Canal taxes for the year}
\]

Depreciation of farm assets has been calculated using the Straight Line Method\(^5\).

\[
\text{Straight Line Method} = \frac{\text{Original value of farm assets} - \text{Salvage value}}{\text{Number of life years}}
\]

Depreciation has been calculated for owned fixed farm assets such as farm sheds, tube wells, electric & oil engines (pumpsets), tractors, seed-drill machine, improved plough, harrow, combine harvester, combine thresher and spray pumps. Further, depreciation of fixed farm assets has been allocated to each crop as follows:

\[
\text{Fixed farm assets depreciation per acre for each crop} = \frac{\text{Area under each crop}}{\text{Gross cropped area}} \times \text{Depreciation}
\]

Fixed Capital includes all farm assets such as farm sheds, tube wells, tractors, seed drill, improved plough, harrow, electric & oil engines, spray pumps, combine

---

\(^{5}\) Original value of farm assets was taken from farmers and the information on number of life years of individual farm assets was received from 'Principles of Evaluation and Allocation of Various Items of Costs', Economics of Agricultural Production and Farm Management in Punjab, Government of Punjab.

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harvester and combine thresher. Chaff-cutter (gandasa) has not been included in fixed capital, because it is not part of any cultivation process. The interest on fixed capital has been charged at 10 per cent per annum for 6 months. The interest on fixed capital has been allocated to each crop as follows:

\[
\text{Interest on fixed capital @ 10 per cent per annum for 6 months per acre for each crop} = \frac{\text{Area under each crop}}{2 \times \text{Gross cropped area}} \times \text{Fixed capital}
\]

From the above explained methodology the cost structure has been tabulated in Table 2.4. The cost structure is broadly divided into two components viz., variable cost and fixed cost. While variable costs vary with the level of crop production, fixed costs remain fixed irrespective of the level of crop production.

<table>
<thead>
<tr>
<th>Table 2.4: Cost Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable Costs</strong></td>
</tr>
<tr>
<td>A1 Casual Labour</td>
</tr>
<tr>
<td>A2 Attached Labour</td>
</tr>
<tr>
<td>A3 Family Labour</td>
</tr>
<tr>
<td>A TOTAL HUMAN LABOUR</td>
</tr>
<tr>
<td>(A1+A2+A3)</td>
</tr>
<tr>
<td>B1 Hired Machine Labour</td>
</tr>
<tr>
<td>B2 Own Machine Labour</td>
</tr>
<tr>
<td>B TOTAL MACHINE LABOUR</td>
</tr>
<tr>
<td>(B1+B2)</td>
</tr>
<tr>
<td>C Seed Costs</td>
</tr>
<tr>
<td>D Fertilizer Costs</td>
</tr>
<tr>
<td>E Insecticides &amp; Pesticides Costs</td>
</tr>
<tr>
<td>F Growth Regulators Costs</td>
</tr>
<tr>
<td>G Irrigation Charges</td>
</tr>
<tr>
<td>H Total Working Capital</td>
</tr>
<tr>
<td>(A+B+C+D+E+F+G)</td>
</tr>
<tr>
<td>I Interest on Working Capital @ 12.5% per annum for 4 months</td>
</tr>
<tr>
<td>J Total Variable Cost (H+I)</td>
</tr>
</tbody>
</table>

In this study only two types of costs have been analysed;

1. Total Cost \( C2 = \) Total Variable Costs + Total Fixed Costs and,

2. Cost \( H = \) Total Working Capital (includes imputed value of family labour).

\[Chapter 2: Database and Methodology\]
2.3.3. Cobb Douglas Production Function

This is a model of aggregate production function and is named after its American originators. Cobb-Douglas production function can be specified as;

\[ Y = AK^aL^b \]

Where,

'\( Y \)' is aggregate output

'\( K \)' is capital

'\( L \)' is labour

'\( A \)', '\( a \)' and '\( b \)' are positive constants.

By expressing the function in logarithmic form, linearity can be introduced. The regression coefficients directly provide the production elasticities. Further, returns to scale can be derived from the values of \( a \) and \( b \). That is, if \( a+b=1 \) function has constant returns to scale.

In this study the variables in the Cobb Douglas production function have been estimated in absolute terms and the log linear transformation of this production function has been stated as follows;

\[
\log GVO = \log C + b_1 \log NCA + b_2 \log HL + b_3 \log MLD + b_4 \log S + b_5 \log FIG + b_6 \log I
\]

Where,

\( GVO \) = Gross Value of Output (Rs)

\( NCA \) = Net cultivated area (Acres)

\( HL \) = Human labour use (Rs)

\( MLD \) = Machine Labour and Depreciation Charges (Rs)

\( S \) = Seed costs (Rs)

\( FIG \) = Fertilizer, Insecticide & Growth Regulators costs (Rs)

\( I \) = Irrigation costs (Rs).

The value of each variable was calculated using the actual price paid by the farmer at the time of farm operation. This exercise was also done separately for Basmati.
2.3.4. Productivity Function

In this study productivity function been estimated taking the aggregate output of all crops in relative terms i.e.

\[ GVO_{ac} = f(NCA, HL_{ac}, MLD_{ac}, S_{ac}, FIG_{ac}, I_{ac}) \]

Where,

- \( GVO_{ac} \) = Gross Value of Output (Rs/Ac)
- \( NCA \) = Net cultivated area (Acre)
- \( HL_{ac} \) = Human labour use (Rs/Ac)
- \( MLD_{ac} \) = Machine labour and Depreciation charges (Rs/Ac)
- \( S_{ac} \) = Seed costs (Rs/Ac)
- \( FIG_{ac} \) = Fertilizer, Insecticide & Growth Regulators costs (Rs/Ac)
- \( I_{ac} \) = Irrigation costs (Rs/Ac)

This exercise was also done separately for Basmati.

2.3.5. Growth Rates using Semi-Log Function

The equation of Semi-log Function is as follows;

\[ Y = ab^t \]

Where,

- \( y \) is the dependent variable for which growth rate is estimated i.e., Basmati rice export quantity or export prices
- \( t \) is time variable
- \( b \) is regression coefficient
- \( a \) is intercept.

The growth rate \( 'r' \) is obtained from the logarithmic form of the equation as follows;

\[ \log y = \log a + t \log b. \]

Thereafter the growth rate ('r' in per cent) is calculated as;

\[ r = (\text{Antilog of } \log b - 1) \times 100 \]

2.3.6. Domestic Resource Cost Ratio (DRCR)

The DRCR measures the efficiency of domestic production of a particular commodity or its international competitiveness. DRCR can be defined as the value of domestic resources needed to earn or save a unit of foreign exchange through the production of the commodity. The DRCR is measured as the ratio of the cost of domestic/primary resources evaluated at shadow prices to the net foreign exchange earnings i.e., traded resources.
output value minus value of traded inputs evaluated at border prices. These coefficients indicate greater international competitiveness of a crop if the coefficients are lower than unity. Symbolically, it is defined as;

\[ DRC_i = \frac{\sum_{j=k+1}^{n} a_j V_j}{P_i^b - \sum_{j=1}^{k} a_j P_j^b} \]

Where,

- \( DRC_i \) is the domestic resource cost of the \( i \)th commodity
- \( a_j \) is the quantity of \( j \)th input required to produce \( i \)th commodity
- \( V_j \) is the shadow price of \( j \)th domestic resource or non-traded input
- \( P_i^b \) is the border price of the \( i \)th commodity adjusted for transportation, handling and marketing charges
- \( P_j^b \) is the border price of the \( j \)th traded input adjusted for transportation, handling and marketing charges
- \( j=1 \) to \( k \) is the directly traded inputs and traded components of non-traded inputs
- \( j=k+1 \) to \( n \) is the primary inputs and the non-traded components of non-traded inputs

### 2.3.7 Nominal Protection Coefficient (NPC)

The NPC is a method to determine the export competitiveness of a commodity. The NPC is the ratio of Domestic price of a commodity to its Border price. The variant of NPC reveals that a particular commodity is efficient exportable, if the NPC is less than unity. Symbolically,

\[ NPC = \frac{P^d}{P^b} \]

Where,

- \( NPC \) = Nominal Protection Coefficient of the commodity under consideration
- \( P^d \) = Domestic Price of the commodity
- \( P^b \) = Border or Reference price of the commodity after taking care of transportation and marketing expenses.
2.3.8. Balassa’s Export Performance Ratios (EPRs)\(^6\)

In order to arrive at the comparative advantage of rice exports Balassa’s Export Performance Ratios (EPRs) have been calculated. Symbolically it can be expressed as;

\[
EPR = \frac{X_k / X_r}{W_k / W_r}
\]

Where,

\(X_k\) = Total value of export of a selected commodity from India / Pakistan

\(X_r\) = Total value of merchandise exports from India/Pakistan

\(W_k\) = Total value of world export of a selected commodity

\(W_r\) = Total value of merchandise exports of the world

If EPR is less than unity the commodity under consideration is said to have comparative advantage in the international market.

2.3.9. Price Elasticity of Demand

To test the price sensitivity of Basmati rice price elasticities were also calculated. The coefficient of price elasticity has been calculated numerically for each year from 1980-81 to 2005-06 according to the following formula;

\[
\text{Price elasticity of demand (E\(^d\))} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}
\]

Apart from this the price elasticity was also calculated for all the years together by using double log regression. The ‘\(y\)’ and ‘\(x\)’ variables in this regression are taken in log terms and hence it is called a ‘double-log regression’. The equation is expressed as follows;

\[
y = a + x^b
\]

\[
\log y = a + b \log x
\]

\[
\log y = f (\log x)
\]

Where,

'y' is the export demand for Basmati rice
'a' is the intercept
'b' is the regression coefficient
'x' is the export price of Basmati rice

It is important to mention at the outset that the selected sample districts of Amritsar and Gurdaspur are relatively backward agricultural districts of Punjab but are well known for producing good quality Basmati rice whereas the selected sample districts of Karnal and Panipat are the agriculturally most developed districts of Haryana (Appendix Table A-2 and Appendix Table A-3). These differences should be taken into consideration while comparing the results of Basmati cultivation between Punjab and Haryana.

Analysis of Basmati has been compared with Non-Basmati wherever it was necessary. Throughout the study, the comparison has also been made across acreage farm categories in each state through tabular and regression analysis.

Further, Basmati Rice trade statistics has also been analysed to study the behaviour of Basmati exports from India and Pakistan. The analysis of impact of WTO on Basmati has been done for two time periods wherein the establishment of the WTO in 1995 has been taken to be the benchmark. Thus, the two time periods are Pre-WTO (1980 - 1994) and Post-WTO (1995 - 2005).