Chapter 2

Sample and Methodology

As was mentioned earlier (Table 1.1) in Gujarat many major and minor irrigation projects were initiated during the successive five year plans. There are 17 river basins in Gujarat region, 71 in Saurashtra and 97 in Kutch region of the state. With water available from interstate rivers like Narmada, Tapti, Mahi and Sabarmati the surface water resources of the state is estimated at 40,700 million M$^3$ (33mcft). There are 141 irrigation projects in the three regions of the state with the storage capacity of 5,29,608 mcft.

In order to study the impact of irrigation it would be ideal to study a semi-arid region with poor rainfall rather than a command area with assured water supply to its command. Dantiwada irrigation project represents a typical semi arid tropical area with a combination of high temperature and low rainfall. Dantiwada project is located on the river Banas near village Dantiwada of Dhanrera taluka in Banaskantha district.

2.1 Climate

The rainfall in the region varied between 114 mm to 1458 mm during the period 1972-1997 with a normal rainfall of 620 mm. The
concentration of the monsoon was mostly in the he months of June and September. The mean annual temperature is 26.4°C with mean May/June temperature going as high as 46° C. The average annual evaporation on Isopleth Map of India works out to 2250 mm.

2.2 Topography and Soils

The general slope of the command is oriented from North East to South West falling towards major rivers such as Banas and Chekaria and rivulets in the area. Plain and gentle sloping (0-1 per cent) land occupy 80.3 per cent of the command area while 19.7 per cent falls in the category of 1-3 per cent (Table 2.1).

Table 2.1: Soil And Other Physical Characteristic Of Dantiwada Command

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Soil Character</th>
<th>Character Range</th>
<th>Area (G C A)</th>
<th>Area Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil Zone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) Ranpur</td>
<td>14,265</td>
<td>17.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii) Samau</td>
<td>37,480</td>
<td>46.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii) Jungral</td>
<td>26,643</td>
<td>32.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv) Bhatsu</td>
<td>592</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>v) Laxmipura</td>
<td>2,110</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Soil Slope (%)</td>
<td>1) 0 - 1</td>
<td>65,073</td>
<td>80.3</td>
</tr>
<tr>
<td></td>
<td>2) 1 - 3</td>
<td>15,927</td>
<td>19.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Soil Texture</td>
<td>a) Sandy loam</td>
<td>53,568</td>
<td>66.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Coarse textured soil)</td>
<td>27,432</td>
<td>33.9</td>
</tr>
<tr>
<td>4</td>
<td>Permeability of the least permeable layer</td>
<td>i) 0 13 - 0 50</td>
<td>7,209</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) 0 5 - 2 00</td>
<td>37,908</td>
<td>46.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) 2 0 - 5 00</td>
<td>27,702</td>
<td>34.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv) 5 0 and more</td>
<td>8,181</td>
<td>10.1</td>
</tr>
<tr>
<td>5</td>
<td>Land Irrigability</td>
<td>Class 1</td>
<td>23,955</td>
<td>29.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 2</td>
<td>54,976</td>
<td>67.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 3</td>
<td>1,396</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 4</td>
<td>673</td>
<td>0.8</td>
</tr>
</tbody>
</table>

The soil in the command area comprise of recent and sub recent alluvials driven from granitis, graisses and quart sites of the Aravalli system and predominantly mixed with acolian sand and silts. There are five main soil series out of which “Saman Soil Series” occupies major portion of the command (46 per cent) area. The surplus layer comprised of 66.1 per cent sandy loam and 33 0 per cent clay loam.

2.3 Salient Features of the Dantiwada Project

Dantiwada dam project work was started in 1958 and completed in 1965. The dam consists of masonry spillway in the river gorge portion of the earthen dam on both flanks. The gross storage and line storage capacity of the reservoir are 464.12 mcmt (16000mcft) and 444 45 mcmt (15705 mcft) respectively. Total catchment area at the dam site is 2862 sq kms The project benefits 102 villages and irrigates 44,534 hectares Table 2.2 shows the salient features of the project.

Table 2.2  Features of the Dantiwada Project

* GENERAL

A) Location of Dam

i) River Band
   ii) Village Dantiwada
   iii) Taluka Dhanera
   iv) District Banaskantha
B) Catchment Area

i) Dam site 2862 sq.km.
ii) Intercepted 598 sq.km.
iii) Net 2264 sq.km.

* HYDROLOGY

i) Mean annual rainfall 620 mm
ii) Yield at 60% reliability 389.07 mm
iii) Flood 18112 MCM

* RESERVOIR

i) F.R.L. 184.10 mm
ii) H.F.L 185.02 mm
iii) Gross Storage 464.12 MCM
iv) Live Storate 444.45 MCM

* CANALS

i) Main Canal
   Capacity 1,1000 cusecs
   (31.13 m³/sec.)
   Length 48 kms.

ii) Gadh Branch Canal
   Capacity 370 cusecs
   Length 32 kms.

iii) Distributary System
   Length 672 kms.

iv) Type
    Sandwitched bricked lining in main canal and branch canal

* COMMAND AREA

i) Gross Command Area 80,972 ha
ii) Culturable Command Area 54,656 ha
iii) Irrigable Command Area 44,534 ha
iv) Irrigation Potential 44,534 ha
v) Nos. of Villages benefitted 102
2.4 Selection of Minor Canal

A list of irrigation divisions of the Dantiwada project along with the area irrigated for each division was collected. From the list an intensively irrigated canal division, the Nandotra branch canal was selected purposively. After discussions with the officials, Koita sub minor was selected for our study.

2.5 Selection of Villages

A list of villages drawing water from the sub minor was compiled and classified into three groups depending upon their location as head, middle and tail. Two villages each from the three groups were randomly selected. Thus the villages Rampur and Colony were selected from the head section, Koita and Nava from the middle section and Jangral and Laxmipura in the tail section.
2.6 Selection of Farmers

To select the sample farmers first villagewise list of farmers was prepared and classified according to their size of holdings as under.

Table 2.3: Classification of Land Holding

<table>
<thead>
<tr>
<th>Land Holding</th>
<th>Marginal farmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 hectare</td>
<td>Marginal farmer</td>
</tr>
<tr>
<td>1.01 to 2 hectares</td>
<td>Small farmer</td>
</tr>
<tr>
<td>2.01 to 4 hectares</td>
<td>Medium farmer</td>
</tr>
<tr>
<td>4.01 and above</td>
<td>Large Farmer</td>
</tr>
</tbody>
</table>

It was decided about 20 per cent of farmers from each selected villages and for each group would be fairly representative. From the head located villages 46 farmers were selected of which 17 marginal, 14 small 12 medium and 3 were large farmers. In the middle location 14 marginal, 13 small 7 medium and 3 large farmers totalling 37 farmers were selected. In the tail section 64 farmers were selected of which 26 marginal, 17 small 18 medium and 3 large farmers. Thus, a total of 147 farmers were selected with six villages of which 57 were marginal, 44 small, 37 medium and 9 large farmers (Table 2.4).

Table 2.4: No of Sample Farmers

<table>
<thead>
<tr>
<th></th>
<th>Head</th>
<th>Middle</th>
<th>Tail</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marginal</td>
<td>17</td>
<td>14</td>
<td>26</td>
<td>57</td>
</tr>
<tr>
<td>Small</td>
<td>14</td>
<td>13</td>
<td>17</td>
<td>44</td>
</tr>
<tr>
<td>Medium</td>
<td>12</td>
<td>7</td>
<td>18</td>
<td>37</td>
</tr>
<tr>
<td>Large</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Overall</td>
<td>46</td>
<td>37</td>
<td>64</td>
<td>147</td>
</tr>
</tbody>
</table>
2.7 Methodology and Period of Study

The study is empirical in nature and based on primary data. Questionnaire cum survey method was used to collect the necessary data and information from the sample farmers (Appendix 2.1). The data pertains to the agricultural year 1997-98. The scope of the study is limited to Dantiwada Command Area and for the year 1997-98. The study is restricted to canal irrigation and other forms of irrigation such as open well, tube wells, ponds etc are not considered.

The data collected from the farmers is analysed using tabular method and appropriate statistical tools. The impact of location of the farm on the cropping pattern, the levels of inputs used and output produced were found using tabular methods. Cost benefit analysis was used to find out the production and profitability of different farms with regard to location and size. To study the return to scale with regard to location Cobb Douglas production function for four major crops were estimated.

2.8 Concept Used in the Study

i) 'U' shaped relationship across locations

When input/output quantities are high at head and tail locations and low at middle location, the shape of the relationship is 'U' shaped.
ii) Inverse ‘U’ shaped relationship across locations

When input/output quantities are low at head and tail locations of canal and high at middle location, the relationship is inverse ‘U’ shaped.

iii) ‘U’ shaped relationship across size groups

When input/output quantities are high for marginal and large size groups as compared to those for small and medium size groups, the relationship is ‘U’ shaped.

iv) Inverse 'U' shape relationship across size groups

When input/output quantities are low for marginal and large size groups as compared to those for small and medium, the resulting relationship is inverse ‘U’ shaped.

v) Negative relationship across locations

If input/output quantities are low for marginal and large size groups as compared to those for small and medium, the resulting relationship is inverse ‘U’ shaped.

vi) Negative relationship across farm size

When input/output quantity decreases in farm size, it is a negative relationship.

vii) Positive relationship across locations

If input/output quantity increases across locations at head, middle and tail locations, then it is positive relationship.

viii) Positive relationship across farm size
When input/output quantity increases with increase in farm size, it is positive relationship.
DANTIWADA IRRIGATION PROJECT
JAGRAL MINOR TAIL LOCATION

LEGEND

== EXISTING WATER COURSES
--- COMMAND OF OUTLET