Chapter 7

Summary and Conclusions

Irrigation is a vital component of green revolution technology without which the potential of seed and benefits of chemical fertiliser cannot be realised. Government of India gave lot of importance to major and minor irrigation projects with the strategy to insulate Indian agriculture from the vagaries of the monsoon. In the state of Gujarat many major and minor irrigation projects have been established since independence. However, canal irrigation had brought about lop sided development. While farmers who got the irrigation benefited immensely others languished. Even among the farmers who got the irrigation facilities the benefits have been uneven. Farmers in the head position of canal or distributary benefited more compared to farmers in the middle and tail location.

This study was undertaken to understand the inputs use and productivity among the farmers of a distributory of the Dantiwada command area. 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 and Koita sub minor was selected after discussions with
officials of the project. A list of villages drawing water from the sub minor was compiled and classified into three groups depending upon their locations at head, middle and tail. A villagewise list of farmers was prepared and classified according to size of holdings. It was decided that 20 per cent of farmers from each selected villages and for each group would be representative. Thus a sample of 147 farmers was drawn. Questionnaire cum survey method was used to collect the necessary data and information from the sample farmers. The data was analysed using tabular methods and appropriate statistical tools were used wherever necessary. Cost benefit analysis was used to find out the production and profitability of different farms with regard to location and size.

7.1 Major Findings

Size of farms as well as its location influenced the cropping pattern. Wheat was the dominant crop in the head and middle location but it was castor in the tail location. There seems to be a definite shift from water intensive crops to less water required crops from head to tail location of the minor. The irrigation intensity was higher at the head location. Irrigation intensity decreases as the distance of the farm from the minor increases. There was a negative relationship between irrigation intensity and location of the farm. The cropping intensity had a u type relation to farm size.
7.2 Wheat

Location

Location did not show any relation to tractor use. Use of bullock labour decreased as the distance increased for all categories of farmers. Quantity of seed used increased with the distance. There was no pattern in the use of FYM to location. Fertiliser use and location of the farm had a U type relation.

Farm Size

Use of all inputs increases with increase in farm size except seed used in the head location. In the middle location use of inputs had a positive relation to farm size except seed. In the tail location use of various inputs was positively related to farm size.

Output

Yield showed a positive relation to farm size but negative relation to distance.

7.3 Mustard

Location

Use of tractor hours decreased as the distance of farm increased for marginal farmers. For medium farmers location had a positive relation to tractor use. For small farmers tractor use showed a U shaped relation.
The use of bullock pair days did not show any pattern for marginal and small farmers. In case of medium farmers use of bullock pair days increased with the distance. Use of seed showed a positive relation to location for marginal and small farmers and no relationship in case of medium farmers. Use of FYM was positive to distance of the farm for marginal farmers but negative relationship for medium farmers. For small farmers it was a U type relation. Use of chemical fertiliser showed a negative relation to location for small farmers. For marginal and medium farmers there was an inverse U type relation. No of mandays used showed a positive relation to distance for medium farmers. For marginal farmers and small farmers there was an inverse relation between labour use and location.

Farm Size

Use of tractor showed a positive relation to farm size in middle and tail location but no relation to the head location. Use of bullock pair days was positive to location at head and tail location but not so in the middle location. Small farmers in all the three location used more seed than marginal and medium farmers. Use of farmyard manure showed a positive relation to size of farm at head location but negative relation in the tail location. In the middle location there is a U type relation. Use of fertiliser showed a positive relation to farm size in the middle location. In the head location the relationship was inverse U and in the tail location a U type
relation Human labour was positive to farm size at tail location. In case of head and middle location the relationship was inverse U. Human labour was positive to farm size at tail location. In case of head and middle location the relationship was inverse U.

Output

Yield was negative to location for small farmers. No trend for marginal and medium farmers was observed. Size of farm showed a positive relation to yield in the middle location but not in the other two locations.

7.4 Castor

Location

The use of tractor was high at the tail location and low in the middle location for all categories of farmers. Bullock labour had a negative relation to distance of the farm from the minor for marginal farmers. It was U type relation for small farmers. In case of large farmers the relationship was positive Seed used by all type of farmers was more or less same Farm yard manure use was positively related to location for marginal and small farmers In case of medium farmers there was U type relation. Use of fertilisers showed a U shaped relationship to the distance for marginal and
small farmers and positive relation for medium farmers and a negative relation to large farmers. Use of human labour showed a positive relation to distance of the farm for small farmers negative for medium farmers and large farmers.

Farm Size

Tractor use showed a positive relation to farm size in all three locations. Use of bullock labour did not show any trend. In the middle location use of bullock labour showed a positive relation to farm size. There was no trend in the tail location.

Use of seed showed no particular relation to farm size in the three locations. Farm yard manure use showed a positive relation at the head location. No trend in the other two locations was found. Fertiliser use showed a positive relation to farm size in the middle and tail locations. Use of human labour showed a positive relation in the middle location. There was no trend in the other two locations.

Output

Output showed a positive relation to location except for small farmers. Yield of castor shows a positive relation to size of farm in the middle and tail locations.
7.5 Bajra

Location

Use of tractors showed a negative relation and bullock labour showed a positive relation to the distance of the farm for marginal farmers. Use of seed showed a positive relation to distance of farm for both marginal and small farmers. Use of human labour showed an inverse U relation.

Farm Size

Use of farm inputs had a positive relation to size of farm in the head location. In the middle location tractor, seed, FYM showed a positive relation to size of farm, bullock labour, fertiliser and human labour showed a negative relation. Tractor use showed a positive relation to size of farm, it was negative for bullock labour. FYM use was positive to farm size but no relationship in case of seed, fertiliser and human labour.

Output

Output showed a negative relation to location in case of small farmers. For marginal farmers there was an inverse U type relation. Yield showed a positive relation to farm size to all three locations.
7.6 Cotton

Location

Use of tractor hours showed a positive relation to location in case of medium farmers. For large farmers it was negative. Bullock labour was positive to distance for medium and large farmers. The use of seed and human labour showed a positive relation to distance of the farm. In case of FYM there was negative relation to distance for medium farmers and positive to large farmers.

Farm Size

The use of tractor and farm yard manure increases with the increase in size of the farm at the head location but other inputs showed a negative relation. In the middle location use of tractor and human labour showed a negative relation to farm size but other inputs showed a positive relation.

Output

Yield showed a negative relation to location and positive to farm size.
7.9 Vegetables

Location

Tractor hours used showed a negative relation to location for small farmers. For medium and large farmers there was a positive relation. Bullock pair days used was positive in case of small and large farmers. Use of seed showed a positive relation to location for small farmers, for medium and large farmers it was negative. Farm yard manure was negative for small farmers it was positive for medium and large farmers. Fertiliser use showed a positive relation to location for all categories of farmers. Use of human labour showed a positive relation to location for small and medium farmers and an negative relation to large farmers.

Farm Size

In the middle location except tractor hours and bullock pair days all the other inputs showed a positive relation to size of the farm. In the tail location tractor and FYM showed a positive relation to farm size. See used showed a negative relation, fertiliser and labour did not show any pattern.

Output

Output showed a positive relation to location for small and medium farmers. For large farmers the relationship was negative. Size of farm and yield showed a positive relation in the middle location. There was no trend in the tail location.
7.10 Potato

Location

Tractor hours showed a negative relation to the location for all farmers. Bullock pair days showed a positive relation for marginal farmers. For others there was no trend. Use of seed showed a positive relation to location for small, large and medium farmers but a U type relation in case of large farmers. Farmyard manure use showed positive relation to location for marginal farmers but negative for small farmers and U type relation for large farmers. Human labour use had a positive relation for marginal farmers negative for small farmers and U type for large farmers.

Farm Size

Farm size had a positive relation in case of tractor use. Seed use showed a positive relation to farm size but no trend in other two locations. FYM use showed a positive relation to farm size at the head and tail location but no trend in the middle location. Fertiliser use showed a positive relation to farm size in the head and middle location. Use of human labour showed a similar trend.

Output

Yield of potato showed a positive relation to distance for marginal farmers for others it was negatively related. Farm size had a positive relation to yield at head and tail location but no trend in the middle location.
The findings with regard to gross benefit is as follows:

Wheat

Farm Size

All the four categories of farmers in the head location got highest gross benefit. All the four categories of farmers in the tail location got the minimum gross benefit. Gross benefit of Rs 12454.5 for large farmers at head location was maximum (maximum among the maximum). Gross benefit of Rs 7662.9 for marginal farmers at head location was minimum (minimum among the maximum). Maximum gross benefit was Rs 9379.5 for large farmers at tail location (maximum among minimum). For marginal farmers in the tail location the gross benefit is Rs 5362.7 at tail location (minimum among minimum). Thus head located farmers were having highest benefit and tail located farmers had lowest benefit.

Location

Large farmers had the highest gross benefit in all the three locations. Marginal farmers had lowest gross benefit in all the three locations. Large farmers at the head location got the maximax (maximum among the maximum) with Rs 12454.5. Minimum among the maximum gross benefit that is minimax was for large farmers in the tail location with Rs 9379.5. Maximin that is maximum among minimum gross benefit accrued to marginal farmers Rs 5362.7 at the tail location.
Mustard

Farm Size

None of the large farmers grew mustard. Small farmers at the head location got the maximum gross benefit Rs 11204.3. this was the maximum among the maximum for all categories of farmers. Minimum among maximum gross benefit Rs 9745 went to marginal farmers at head location. Small farmers in the middle location got gross benefit of Rs 8245.4 which was maximum among the minimum.

Location

Minimin, that is, minimum gross benefit among minimum was realized by medium farmers in the tail section. Small farmers in the head location got the highest gross benefit. Small farmers in the tail location got the minimax benefit i.e. minimum among the maximum gross benefit. Medium farmers in the tail location got minimum gross benefit which is minimum of minimum. Medium farmers in the head location got maximum of minimum gross benefit. While small farmers at the head location received the maximum of maximum gross benefit from mustard medium farmers in the tail location got the minimum returns from the crop.

Unlike in wheat neither farm size nor location had any systematic relation to gross benefit.
Bajra

Farm Size

None of the large farmers in the sample grew bajra. Medium farmers did not grow bajra at head and middle location. Only two categories of farmers: small and marginal grew bajra in all the three locations. Highest gross benefit accrued to small farmers in the middle location (Rs 7357.4). Lowest gross benefit was received by marginal farmers (RS 4343.3) in the tail location.

Location

Maximax gross benefit was realized by small farmers in the middle location whereas their counterparts in the tail location got minimax that is minimum gross returns among the maximum in the three locations. Marginal farmers at the middle location got the maximum among the minimum returns while their counterparts in the tail location received minimum of minimum of returns.

Thus location did not seem to influence gross benefit size of farm seemed to have a bearing on gross returns. Since bajra is a less water intensive crop location of the farm close to head had no impact on returns.

Castor

Farm Size

Marginal farmers in the head location got the maximum of maximum gross benefits (Rs 14006.6) amongst the four categories of farmers. Small
farmers in the middle location realized Rs 11859.9 per hectare which was minimum among the maximum gross benefit.

When we examined the minimum gross benefit the minimum of the minimum gross benefit was realized by marginal farmers. Large farmers in the tail location got maximum of the minimum gross returns.

Location

The maximum among the maximum gross benefit was realized by marginal farmers in the head location while large farmers in the tail location realized the minimum of maximum benefits. Marginal farmers in the middle location got the minimum of minimum gross benefits while small farmers at the head location got maximum of minimum returns.

Cotton

None of the sample farmers in the tail location, none of the marginal and small farmers in the middle location were growing cotton. Therefore, it would not be possible to examine the farm size and location on gross benefit from the crop. However, for the rest of the sample farmers the gross benefit was maximum for large farmers in the head location (Rs
28684.3) and the minimum was realized by medium farmers in the middle location (Rs 16646.5).

Potato

Farm Size

That large farmers in the middle location had maximum of maximum benefits of Rs 30166.1 whereas small farmers at middle location had minimum of maximum gross benefit of Rs 25237.2. Marginal farmers in the head location realized maximum of minimum gross benefit and small farmers in the tail location got minimum of minimum gross benefit of Rs 19901.4.

Location

None of the small farmers in the head location and none of the marginal farmers in the tail location were growing potato. Large farmers in the middle location realized the maximum gross benefit and their counterparts in the tail location got minimum of maximum benefits. Small farmers in the middle location got maximum of minimum benefits whereas the small farmers at the tail location got minimum of minimum gross returns.
Vegetables

None of the sample farmers in the head location and none of the marginal farmers in the middle location were growing vegetables. For other farmers the highest or maximum gross benefits was Rs 16983 1 for large farmers at the middle location. The lowest gross benefit was realized by Rs 10671.5 for marginal farmers at the tail location.

In order to examine yield of the crop in relation to location of the farm and other important inputs a Cobb Douglas production function was calculated. The returns to scale are increasing for wheat, castor and mustard but diminishing in case of bajra. The influence of location of the farm on yield of wheat was very high compared to other three crops.

Location of farm significantly affected yield of wheat. Seed was another variable which was significant. All other variables except bullock labour though not significant had a positive sign.

Location of the farm had a positive impact on yield however, it was not significant. Seed and fertiliser were significant at 1 per cent level. Tractor and human labour had negative elasticities.
Location of the farm was significantly related to yield. Seed used was significant. Elasticities for all inputs except bulloks showed positive relation to yield.

Location of the farm negatively related to yield. Fertiliser used and bullock pair days were significantly related to yield. All other inputs though not significant had a positive sign.

**Policy Implications**

Location of the farm influenced the cropping pattern as well as intensity of irrigation. This implies farmers at the head location benefited more compared to their counterparts in the middle and tail location of the minor. A more equitable distribution of water might help especially tail end farmers which would in turn help in realizing the full potential of the irrigation project. The Dantewada Command Area project is managed by the officials of the irrigation department of the state government instead if the distribution of the water is managed by a farmer's organisation most of the undesirable practices found in the distribution of water could be eliminated. There are many instances in South Asia where irrigation schemes controlled by farmers organisation were found to be more efficient. In India moves are afoot to introduce similar experiments. It is hightime that such a system is introduced in the command area. Farmers
can form a committee, which would be represented by all categories of farmers such as marginal, small, medium and large from all the three locations. Officials of the irrigation department must also form part of the committee but confine their role to giving technical inputs. Decisions regarding the distribution of available water should be left to the farmers' representatives.

Use of different inputs differed across farm size and location for different crops. Location of the farm seemed to have some influence over use of inputs than the size of the farm. Better-endowed farmers not necessarily big farmers used more inputs. However, use of all inputs were sub optimal for all categories of farmers at all three locations, especially the use of chemical fertilizers is much below the recommended rate for almost all crops. Pesticide use was not widespread even in a crop like cotton which needs intensive spraying of pesticides. Only few farmers used pesticides for cotton. Therefore, it is pertinent to improve the use of various inputs to the optimal level in order to increase the productivity of different crops for all categories of farmers. The training and visit system of extension introduced more than one and half decade ago is more or less moribund. The system needs to be improved, the frequency of contact between the farmer and the T and V workers should be increased.
Barring one or two inputs in one or two crops the elasticity of output to input use was positive indicating increase in these inputs would increase the output. There was an increasing returns to scale for major crops. This further reinforces the argument that the input use by the farmers in the Dantiwada Command area was sub optimal. Any increase in input use from the current level should be preceded by increase in credit availability. Co-operative movement is a success story in Gujarat. All the villages in the selected area have primary agricultural credit co-operatives. Though availability of credit for agriculture is not a problem there are issues about its sufficiency especially to resource poor marginal and small farmers. Therefore, enhancement of credit limit, extending it to vulnerable groups of farmers would help to increase input use.

Location of the farm rather than size of the farm seemed to have some influence on gross benefits. Marginal farmers in castor, small farmers in bajra and mustard realised highest gross benefit. However, none of the four categories of farmers in the tail location realized highest gross benefit for any of the crops. In most of the crops studied tail end farmers realized the lowest gross benefit. None of the four categories of farmers in the head location realized minimum gross benefits in any of the crops. Therefore, as suggested earlier, equitable distribution of water might help the tail end farmers realize full benefits. Optimum use of water and other inputs would help in realizing better benefits for the tail end farmers.