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ECONOMICS OF CROPPING PATTERN AND FARM INCOME UNDER CONJUNCTIVE USE OF WATER

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ABSTRACT

The study examines the economics of cropping pattern and farm income in relation to conjunctive use of water in Bijapur district (Karnataka). The analysis is based on the primary data collected from 296 farmers belonging to different size groups for the crop year 1985-86. The crop enterprises are evaluated by adopting the usual farm management cost concepts. The study reveals a shift in cropping pattern in favour of commercial crops and considerable improvement in cropping intensity with the advent of conjunctive use of water which in turn results in higher income levels on the lands with conjunctive use of water. The per hectare net income from lands with conjunctive use of water is found to be six times more than the level realised on lands without conjunctive use of water.

A number of agricultural inputs like improved seeds, application of balanced fertilizers, improved management and requisite irrigation water are necessary to step up and stabilize crop productivity. Proper development and management of water input, however, is of over-riding importance since the success and efficiency of other inputs is dependent on the quantity, quality and timing of water supply. Thus, the strategic role of irrigation as an essential input for agriculture hardly needs any emphasis.

Irrigation supplied from a single source—surface (canal) or underground (well) —is very often inadequate to meet the requirement of crops in respect of timelines and quantity as well. This is particularly true in respect of high yielding varieties of crops with their more exacting water demands, besides the fact that both traditional and improved varieties are being grown in the command areas in the same season. On account of their differing base periods and critical stages of irrigation, it becomes rather difficult to meet their water requirements from a single source. Both the sources—surface and underground water—have, therefore, been advocated to be used conjunctively in order to meet the varying irrigation requirements.

With the advent of the practice of conjunctive use of water, there has been a considerable improvement in the productivity levels and returns. This has been

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accompanied by significant changes in the levels and pattern of input utilization. The impact of changes in cropping patterns of farms with and without conjunctive use of water on costs and returns of different size groups of farmers has not received adequate attention of previous researchers. The present study is an attempt in this direction. The specific objectives of the present study are to (1) compare the cropping patterns on lands with and without conjunctive use of water and (2) evaluate and compare the costs, returns and profits from lands with and without conjunctive use of water.

Methodology

Since the emphasis of the present study is on economic analysis of conjuctive use of water, Bijapur district (Karnataka), where conjuctive use of water is practised extensively, was purposively selected for the study. A large per cent (about 62%) of the geographical area under Ghataprabha Left Bank Canal lies in Bijapur district. Among the talukas of Bijapur district, the availability of surface water for irrigation and development of ground water resources for irrigation which enable conjunctive use of water is relatively higher in Mudhol and Jamakhandi taluks. Therefore, these two talukas were chosen for the study. Considering the extent of canal irrigation and development of ground water for irrigation, it was decided to randomly select three villages in each of the talukas. The sample of irrigated farms from each of these villages were chosen on the basis of probability proportional to the total number of farmers in each size group of farms—small (below 2.00 hectares), medium (2.01 to 4.00 hectares) and large (above 4.01 hectares). The number of small, medium and large farms chosen for the study were 96, 92 and 100, respectively. The necessary field level data relating to the production of crops on lands with and without conjunctive use of water were obtained from the sample farmers using pretested structured schedules. The data relates to the crop year 1985-86.

The methodology adopted to calculate cropping intensity is similar to that adopted by Gopalaswamy and Nagadevara (1984) wherein appropriate weightage is given to the duration of the occupancy of land by the crops in a year. The per hectare costs, returns and profits of crop enterprises in lands with and without conjunctive use of water are computed and compared using various cost concepts employed in the All-India Farm Management Studies. The details of items included under each of the cost components are as follows :

Cost A : Includes items such as wages of hired human labour, charges of owned and hired bullock labour, value of seeds (farm produced and purchased), value of manures, fertilizers and plant protection chemicals, expenditure on irrigation, depreciation on farm machinery, implements and buildings, land revenue and interest on working capital.

Cost B : Includes cost A, rental value of land and interest on fixed capital.

Cost C : This consists of cost B and the imputed value of family labour.

Farm Business Income : The difference between the gross income and Cost A represents the farm business income.

Family Labour Income : The difference between the gross income and Cost B represents the family labour income.

Net Income : The difference between the gross income and cost C represents the net income.

Results and Discussion

The proportion of area under different crops are worked out separately based on the nature of irrigation (with or without conjuctive use of water) and are presented in Table 1. On lands conjunctively irrigated, the largest proportion of the gross cropped area is occupied by the annual/perennial crops followed by *kharif*, *rabi*, bi-seasonal and summer crops in all size groups. However, *rabi* crops dominate the lands without conjunctive use of water irrespective of the size of the holdings.

On the lands with conjunctive use of water in all the three size groups of farms, sugarcane is the most predominant crop accounting for 44.55 per cent of the gross cropped area on small farms, 42.55 per cent on medium farms and 44.82 per cent on large farms. *Kharif* maize ranks second, occupying 32.21, 38.07 and 32.84 per cent of the gross cropped area on small, medium and large farms, respectively. The third place is occupied by cotton in the case of small farms and wheat in the case of medium as well as large farms. Fruit crops (banana, grapes, sapota, citrus and mango) account for 2.24, 1.15 and 1.63 per cent of the gross cropped area on small, medium and large farms, respectively.

Food crops dominate the lands without conjunctive use of water occupying the highest proportion of the gross cropped area in general and wheat in the case of small and medium farms and *rabi* jowar in case of large farms in particular.

Cropping intensities on the farms with conjuctive use of water are much higher than those on the respective farms without conjunctive use of water. The cropping intensities declined with increase in size of farms in both the cases.

The farms with conjunctive use of water are able to meet the irrigation requirements both from timeliness and adequacy points of view. Therefore, annual/perennial crops like sugarcane and fruits occupied a higher proportion of the gross cropped area on conjunctively irrigated farms as compared to those without conjunctive use of water. The important inference that may be drawn from such an observation is that with the commissioning of wells on land irrigated by canals or

Table—1. Proportion of Area under Major Crops (Percentages)

Season/Crop	With conjunctive use of water			Without conjunctive use of water		
	Small Farms	Medium Farms	Large Farms	Small Farms	Medium Farms	Large Farms
Kharif						
Maize	32.21	38.07	32.84	10.71	14.89	12.82
Jowar	0.57	—	—	3.04	2.71	5.77
Groundnut	0.98	1.26	0.41	0.76	3.61	4.92
Pigeonpea	—	—	0.51	—	—	0.84
Sunflower	0.21	0.21	0.87	—	0.90	0.47
Vegetables	1.78	1.00	1.53	—	0.75	0.10
Fodder	0.33	1.36	0.82	—	—	0.35
Paddy	0.33	0.42	0.10	—	—	—
Soybean	—	—	0.20	—	0.90	—
Bajra	—	—	—	1.52	1.51	2.34
Sub Total	36.41	42.32	37.28	16.03	25.27	27.61
Rabi						
Wheat	4.84	5.29	5.51	39.75	26.48	15.95
Bengalgram	0.82	1.36	0.56	14.43	9.10	4.59
Jowar	—	2.30	2.76	4.56	19.29	43.43
Maize	2.38	0.79	2.17	15.92	9.10	3.55
Oilseeds	—	—	—	1.52	2.36	1.17
Fodder	—	—	0.20	0.38	1.58	0.10
Vegetables	0.98	0.21	—	0.76	—	0.27
Sub Total	9.02	9.95	11.20	77.32	67.81	69.06
Summer						
Maize	0.57	—	0.10	4.37	1.81	0.51
Groundnut	—	—	0.51	—	—	0.19
Sunflower	—	—	—	—	0.76	0.19
Fodder	—	—	—	—	—	0.19
Sub Total	0.57	—	0.61	4.37	2.56	1.08
Biseason						
Cotton	7.21	4.03	4.46	1.52	2.10	1.03
Sub Total	7.21	4.03	4.46	1.52	2.10	1.03
Annual/Perennials						
Sugarcane	44.55	42.55	44.82	0.76	1.81	1.22
Fruit crops	2.24	1.15	1.63	—	0.45	—
Sub Total	46.79	43.70	46.45	0.76	2.26	1.22
Grand Total	100.00	100.00	100.00	100.00	100.00	100.00
Cropping intensity	230.00	221.35	210.96	192.49	180.07	178.21

with extension of canal water to the lands possessing wells, the proportion of area under high value crops like sugarcane, cotton and fruits to the total cropped area can be increased substantially and this in turn will have a marked effect on the cropping pattern. A critical examination of Table 1 further reveals the tendency of farmers to devote much higher proportion of the area to cash crops on bigger holdings as compared to small holdings. Therefore, the size of cultivated holdings and temporal availability of water appear to be important factors influencing the allocation of area between cash and food crops. Similar results were reported by Majid (1963) and Selvaraj (1966).

In order to have an insight into the impact of conjunctive use of water on farm incomes, an analysis of costs and returns was carried out on a per hectare basis. The results of the analysis are furnished in Table 2 and Table 3. At the overall level, the cost A, cost B and cost C are Rs. 6,222.45, Rs. 9,489.67 and Rs. 10,024.46, respectively, on lands with conjunctive use of water and the corresponding figures for lands without coujunctive use of water are Rs. 1,958.37, Rs. 3,009.73 and Rs. 3,178.48. This implies that the average cost of cultivation of crops per hectare is much higher on lands with conjunctive use of water. The average value of gross output and net income per hectare works out to Rs. 15,918.23 and Rs. 5,897,77, respectively, on lands with conjuctive use of water and Rs. 4,111.94 and Rs. 933.46, respectively, on lands without conjunctive use of water. Thus, the net income per hectare of crop production is higher by 6.42 times on lands with conjunctive use of water compared to that on lands without conjunctive use of water (Table 3).

On medium farms with conjunctive use of water, the per hectare net income is the highest (Rs. 6,044.34) though the value of gross output of crops is the lowest (Rs. 15,569.29). By contrast, the per hectare net income is the lowest on small farms (Rs. 5,598.77), while the value of gross output (Rs 16,890.41) is the highest. This is because the cost C on these farms was much higher compared to any other size group of farms.

On large farms without conjunctive use of water, the cost C, value of gross output and net income per hectare works out to Rs. 2,813.82, Rs. 3,631.88 and Rs. 818.06, respectively, and were the lowest as compared to small and medium farms. But the net income is the highest (Rs. 1,198.88) on medium farms. With increase in farm size the per hectare farm business income increases in both, with and without conjunctive use of water.

It is interesting to note that the ratios of measures of income—value of gross output, farm business income, family labour income and net income—increase with increase in the size of farms, though all the cost (A, B and C) ratios are the highest

Table—2. Costs and Returns in Crop Production with and without Conjunctive Use of Water (Rupees/hectare)

Item	With conjunctive use of water				Without conjunctive use of water			
	Small Farms	Medium Farms	Large Farms	Overall	Small Farms	Medium Farms	Large Farms	Overall
Cost A	6,857.57	5,680.66	6,289.22	6,222.45	2,536.97	2,331.61	1,833.03	1,958.37
Cost B	10,629.46	8,884.79	9,420.66	9,489.67	4,140.90	3,617.27	2,677.56	3,009.73
Cost C	11,291.64	9,524.95	9,867.52	10,020.46	4,476.60	3,823.26	2,813.82	3,178.48
Value of gross output	16,890.41	15,569.29	15,786.57	15,918.23	5,665.12	5,022.14	3,631.88	4,111.94
Farm Business Income	10,032.84	9,888.63	9,497.35	9,695.78	3,108.15	2,690.53	1,798.84	2,153.56
Family Labour Income	6,260.95	6,684.50	6,355.92	6,428.57	1,524.22	1,404.87	954.31	1,102.21
Net Income	5,598.77	6,044.34	5,919.05	5,897.77	1,188.52	1,198.88	818.06	933.46

Table—3. Differentials and Ratios between Costs and Returns in Crop Production with and without Conjunctive Use of Water

Item	Small Farms		Medium Farms		Large Farms		Overall	
	Differentials (Rs)	Ratio	Differentials (Rs)	Ratio	Differentials (Rs)	Ratio	Differentials (Rs)	Ratio
Cost A	4,300.06	2.68	3,349.06	2.44	4,456.18	3.43	4,264.08	3.18
Cost B	6,488.56	2.57	5,267.52	2.46	6,753.10	3.52	6,479.94	3.15
Cost C	6,815.05	2.52	5,701.69	2.49	7,053.71	3.51	6,841.98	3.15
Value of Gross Output	11,225.29	2.98	10,547.15	3.10	12,154.70	4.35	11,806.30	3.87
Farm Business Income	6,924.69	3.23	7,108.09	3.68	7,698.51	5.20	7,542.22	4.51
Family Labour Income	4,736.73	4.11	5,279.63	4.76	5,401.60	6.66	5,326.36	5.83
Net Income	4,410.25	4.71	4,845.46	5.04	5,100.99	7.24	4,964.31	6.42

on large farms (Table 3). Thus, crop production with conjunctive use of water certainly fetched far more pay-off than that without conjunctive use of water in all size groups of farms as well as the aggregate level. Another striking feature of the study is that the incremental income in terms of farm business income, family labour income and net income increased with the increase in the size of farms as one moves from non-conjunctive use of water in crop production, although the cost structure reveals varying differences from one size group of farms to another. Thus, the per hectare income from crop production is higher on lands with conjunctive use of water as compared to those without conjunctive use. The plausible explanations for this could be (1) water requirements of crops during monsoon season are met by surface water (canals) and during dry months through ground water (wells) (2) the above sequencing helps replenishment of ground water through greater recharge during rainy season with the help of surface irrigation net work and (3) the near optimal utllization of water enables higher production per unit of area through the supply of requisite quantity of water at the critical stages of crop growth.

On lands without conjunctive use of water, generally an inverse relationship is noticed between farm size and value of gross output from crop enterprise. Higher profitability on small farms could be attributed to (i) intensive use of family labour and (ii) higher cropping intensity. Similar relationship between farm size and per hectare farm business income was reported by Khusro (1964) and Selvaraj (1966).

Conclusions

The study reveals that with the advent of the practice of conjunctive use of water there has been a considerable improvement in cropping patterns and cropping intensity. On lands with conjunctive use of water, the proportion of area under high value crops to the total cropped area increased substantially. Further, the gross income and net income is higher on lands with conjunctive use of water as compared to that on lands without conjunctive use of water. The average cost of cultivation of crops are also much higher on lands with conjunctive use of water than on lands without conjunctive use of water. Thus, the conjuctive use of surface and ground water generated considerable improvement in the levels of returns and promoted stability in crop productivity. Therefore, the scheme for conjunctive use of surface and ground water should be the on-going prime concern of the policy makers to realise greater economic benefits.

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