

IMPACT OF SPRINKLER IRRIGATION SYSTEM ON DOUBLING FARMERS' INCOME AND WATER USE EFFICIENCY OF TUR IN NORTHERN KARNATAKA

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Abstract: Water is gradually becoming a scarce resource worldwide especially in developing countries like India. The application of irrigation water by conventional method causes up to 30 per cent loss of water through deep percolation depending on the soil type. To achieve More Crop Per Drop, the adoption of sprinkler irrigation gains greater attention. With this backdrop, the study was conducted in two districts of Northern Karnataka namely, Bidar and Kalaburgi. Sixty farmers practicing sprinkler irrigation and sixty farmers practicing conventional method of irrigation in cultivation of tur were selected purposively for the study and thus the total sample size was 120. Purposive multistage random sampling procedure was followed for the selection of the samples. The results of the study revealed that the per hectare net returns and B:C ratio obtained under sprinkler irrigated farms was high (Rs. 86,084/ha & 2.59, respectively) as compared to conventional irrigated farms (Rs. 50,150/ha & 2.02, respectively). Water use efficiency was found to be more under sprinkler irrigation system (2.64 q/ha cm) followed by conventional method of irrigation (0.89 q/ha cm). Thus the cultivation of tur was found to be highly profitable under sprinkler irrigation system compared to tur cultivation under conventional method of irrigation.

Keywords: Sprinkler Irrigation, Conventional Method of Irrigation, Tur, Net Returns, BCR, Water Use Efficiency.

Introduction: India accounts for about 17 per cent of the world population but only 4 per cent of the world fresh water resources. With 1544m³ per capita water availability, India is already declared as water stressed country by international norms. Cross country comparison of water use efficiency shows that India uses 2 to 3 times water to produce one unit of major food crops as compared to other major agricultural countries like China, Brazil and USA. However these challenges provide opportunities to redefine the ways we have to deal with stress on limited water resources in the country. Recognising the importance of water as a critical input to agriculture and to achieve more crop per drop of water used, the adoption of micro irrigation systems like sprinkler irrigation and drip irrigation gains greater attention which enables better control and monitoring of existing water which can be translated into higher water use efficiency in the country in general and state in particular. In the light of the above, the present paper is proposed to evaluate the gain in economic benefits and water use efficiency (WUE) from tur under sprinkler irrigation system over the conventional method of irrigation in northern Karnataka.

Materials and Methods: Sampling Procedure: The purposive multistage random sampling was followed for the selection of districts, taluks, villages and beneficiary farmers. The farmers practicing conventional method of irrigation were selected from the selected villages randomly. Bidar and Kalaburgi districts were selected

purposely for the detailed study. From each selected district one major taluk in terms of availability of farmers practicing sprinkler irrigation system in cultivation of tur were selected purposively. The taluks selected were Bhalki from Bidar district and Afzalpur from Kalaburgi district. Three villages from each selected taluk namely; Kesarajavalga, Saiganv and Telwad from Bhalki taluk and Gour B, Ballurgi and Afzalpur from Afzalpur taluk were selected purposively for the study. From each selected village 10 farmers practicing sprinkler irrigation and 10 farmers practicing conventional method of irrigation (furrow) were selected purposively. Thus sample size was 60 in each irrigation method and thus the total sample size was 120.

Analytical Tools Used: Budgeting technique was followed for estimating the cost and returns and tabular analysis was used to analyse the water use efficiency of tur under different irrigation methods.

Results and Discussion:

Input Use Pattern and Output Obtained In Tur Cultivation under Sprinkler Irrigation System and Conventional Method of Irrigation: It can be observed from the Table 1 that, the average per hectare utilisation of seeds among the different irrigation methods was highest in case of conventional method of irrigation (10.88 kg/ha) compared to sprinkler irrigation (9.54 kg/ha). The average per hectare utilisation of human labour was also highest in case of conventional method of irrigation (78.52 man days) compared to conventional method of irrigation (76.58 man days). Per hectare bullock labour usage in case of sprinkler irrigation was highest (2.56 pair days) compared to conventional method of irrigation (1.71 pair days). However tractor labour used under conventional method of irrigation and sprinkler irrigation were 9.71 hours and 10.03 hours, respectively. It could also be observed from the Table 1 that the use of farm yard manure, chemical fertilisers and plant protection chemicals was also highest under conventional method of irrigation (6.13 t/ha, 3.28 q/ha & 2.17 L/ha, respectively) compared to sprinkler irrigated farms (5.33 t/ha, 2.61 q/ha & 1.75 L/ha, respectively). The highest yield was obtained in case of sprinkler irrigated farms compared to conventional irrigated farms. It was 19.42 q/ha under sprinkler irrigated farms and 13.92 q/ha under conventional irrigated farms. This might be due to the fact that application of water through sprinkler irrigation was uniform and regular and hence less susceptible for weeds, pests and diseases and there was no problem of soil erosion and loss of soil fertility and also due to the other advantages of sprinkler irrigation over the conventional method of irrigation [1].

Cost and Returns Involved In Cultivation of Tur under Sprinkler Irrigation System and Conventional Method of Irrigation: It could be noticed from the Table 2 and 3 that the total variable cost incurred per hectare under conventional method of irrigation was highest (Rs. 39,759/ha) compared to sprinkler irrigated farms (Rs. 38,439/ha). The distribution pattern of operational cost under various inputs revealed that there was no much difference in the cost of human labour under both the methods of irrigation (Rs. 16,273 to 16,293/ha) whereas bullock labour cost in case of sprinkler irrigation and conventional method of irrigation was Rs 2,040/ha and 1,478/ha, respectively. The costs of tractor labour and seeds in case of sprinkler irrigation were Rs. 8,089/ha & Rs. 618/ha, respectively and 7,930/ha and Rs.712/ha in case of conventional method of irrigation, respectively. It could also be observed from the table that expenditure on farm yard manure, chemical fertilisers and plant protection chemicals applied per hectare in the study area was more under conventional method of irrigation (Rs. 6,125/ha, Rs. 5,073/ha & Rs. 801/ha, respectively) and was less in sprinkler irrigated farms (Rs. 5,333/ha, Rs. 4,137/ha & Rs. 647/ha, respectively).

The irrigation method wise analysis indicated that the fixed cost incurred per hectare in case of sprinkler irrigated farms was highest (Rs. 15,793/ha) compared to conventional irrigated farms (Rs. 9,594/ha). Among the different components of fixed cost, rental value of the land was highest in both the methods of irrigation (Rs. 4,375/ha in each method) followed by cost of irrigation which is nothing but amortised cost of irrigation structure (Rs. 8,938/ha & Rs. 2,994/ha under sprinkler and conventional method of irrigation, respectively). The other components like land revenue, depreciation charges and interest on fixed cost are of minor importance. Among the two methods of irrigation, the total cost incurred in case of sprinkler irrigation was highest (Rs. 54,232/ha) as compared to cost incurred in cultivation of tur under conventional method of irrigation (Rs. 49,354/ha). This might be due to the fact that sprinkler irrigation required more fixed costs than conventional method of irrigation. Hence cost of cultivation under sprinkler irrigation was little more compared to conventional method of irrigation in production of tur in the study area [2].

The irrigation method wise analysis of indicated that net returns also, the per hectare net returns obtained in sprinkler irrigated farms was high (Rs. 86,084/ha) as compared to conventionally irrigated farms (Rs.

50,150/ha). This was due to the fact that the tur productivity as well as the price of the output was more under sprinkler irrigation compared to the conventional method of irrigation in cultivation of tur. Thus the cultivation of tur crop in the study area was found to be highly profitable under sprinkler irrigation as also supported by a high magnitude of returns per rupee investment (2.59) compared to tur cultivation under conventional method of irrigation (2.02) [3].

Water Use Efficiency of Tur under Sprinkler Irrigation System and Conventional Method of Irrigation:

The yield was highest under sprinkler irrigation system (19.42 q/ha) followed by conventional method of irrigation (13.52 q/ha). The water use efficiency was also highest under sprinkler irrigation system (2.64 q/ha cm) followed by conventional method of irrigation (0.89 q/ha cm) and whereas water applied was 7.37 ha cm and 15.24 ha cm under sprinkler irrigation and conventional method of irrigation, respectively (Table 4). The water application by the sprinkler irrigation was less because of the fact that even though there was more hours of irrigation under sprinkler irrigation, the water applied per hour was less in case of sprinkler irrigation (7,500 litres) compared to conventional method of irrigation (22,788 litres). Hence application of water through sprinkler irrigation was found to be less compared to conventional method of irrigation [4], [5].

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Table 1: Input Use Pattern and Output Obtained In Tur Cultivation under Sprinkler Irrigation and Conventional Method of Irrigation in the Study Area

(Per ha)

Sl. No.	Particulars	Units	Sprinkler irrigation n=60	Conventional method of irrigation n=60	Difference
1	Human labour	Man days	76.58	78.52	-1.94
2	Bullock labour	Pair days	2.56	1.71	0.85
3	Machine labour	Hours	10.03	9.71	0.32
4	Seeds	Kgs	9.54	10.88	-1.34
5	Farm Yard Manure	Tonnes	5.33	6.13	-0.8
6	Chemical Fertilisers				
	Urea	Quintals	1.16	1.52	-0.36
	DAP	Quintals	0.81	0.93	-0.12
	MOP	Quintals	0.65	0.83	-0.18
	Total	Quintals	2.61	3.28	-0.67
7	Plant Protection Chemicals				
	Pesticide	Litres	1.75	2.17	-0.42
8	Main product	Quintals	19.42	13.92	5.5

Table 2: Returns from Cultivation of Tur under Sprinkler Irrigation and Conventional Method of Irrigation in the Study Area

(Per ha)

Sl. No.	Particulars	Sprinkler irrigation (n=60)	Conventional method of irrigation (n=60)	Difference
1	Yield (quintals)	19.42	13.92	5.50
2	Market price (Rs./q)	7226.67	7150.00	76.67
3	Gross returns (Rs.)	140317.78	99504.17	40813.61
4	Total cost (Rs.)	54232.99	49354.13	4878.86
5	Net returns (Rs.)	86084.79	50150.03	35934.76
6	B:C ratio	2.59	2.02	0.57

Table 3: Water Use Efficiency of Tur under Sprinkler Irrigation and Conventional Method of Irrigation in the Study Area

(Per ha)

Sl. No.	Particulars	Sprinkler irrigation n= 60	Conventional method of irrigation n=60
1	No. of irrigations	7.68	4.37
2	Time required per irrigation (hour)	12.79	15.33
3	Total hours of irrigation	98.23	66.99
4	Water applied per hour (lit)	7500	22752
5	Total water applied (lit)	736725	1524156
6	Water applied in ha cm	7.37	15.24
7	Yield (q/ha)	19.42	13.52
8	Water use efficiency (q/ha cm)	2.64	0.89
9	Gain in WUE under sprinkler irrigation over conventional method of irrigation (%)	66.29	

Note: Water use efficiency = yield/water applied

Table 4: Cost Involved In Cultivation of Tur under Sprinkler Irrigation and Conventional Method of Irrigation in the Study Area
(Per ha)

Sl. No.	Particulars	Sprinkler Irrigation (n=60)			Conventional Method of Irrigation (n=60)			Difference Value (Rs.)
		Quantity	Value (Rs.)	Per cent to total cost	Quantity	Value (Rs.)	Per cent to total cost	
1	Human labour (man days)	76.58	16273.58	30.01	78.52	16293.93	33.01	-20.35
2	Bullock labour (pair days)	2.56	2040.19	3.76	1.71	1478.75	3.00	561.44
3	Machine labour (hours)	10.03	8089.07	14.92	9.71	7930.17	16.07	158.9
4	Seeds (kgs)	9.54	618.62	1.14	10.88	712.31	1.44	-93.69
5	FYM (tonnes)	5.33	5333.33	9.83	6.13	6125.00	12.41	-791.67
6	Chemical Fertilisers (Quintals)							
	Urea	1.16	820.94	1.51	1.52	1079.79	2.19	-258.85
	DAP	0.81	1915.06	3.53	0.93	2185.14	4.43	-270.08
	MOP	0.65	1401.46	2.58	0.83	1808.33	3.66	-406.87
	Total	2.61	4137.46	7.63	3.28	5073.26	10.28	-935.8
7	Plant Protection Chemicals (Litres)							
	Pesticide	1.75	647.50	1.19	2.17	801.67	1.62	-154.17
8	Interest on working capital @ 7%		1299.89	2.40		1344.53	2.72	-44.64
A.	Total variable cost		38439.64	70.88		39759.62	80.56	-1319.98
1	Land revenue		30.00	0.06		30.00	0.06	0
2	Rental value of the land		4375.00	8.07		4375.00	8.86	0
3	Depreciation		1556.26	2.87		1651.60	3.35	-95.34
4	Apportioned cost of irrigation structure		8938.13	16.48		2994.82	6.07	5943.31
5	Interest on fixed capital @ 12%		893.96	1.65		543.09	1.10	350.87
B.	Total fixed cost		15793.35	29.12		9594.51	19.44	6198.84
	Total cost of cultivation		54232.99	100.00		49354.13	100.00	4878.86
