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Economics of Cropping Systems in Command Area of Kal Irrigation Project in Raigad District (Maharashtra State)

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Abstract—*The study has worked out the economics with cost, returns and profitability of major cropping systems in the Command area of Kal irrigation project in Raigad district by randomly selecting 90 farmers from the three reaches of Command Area viz. head, middle and tail reach from study area. For study, three major rice based cropping systems were identified viz., i) Kharif Rice + Summer Rice (CS-I) followed by 34.56 per cent farmers, ii) Kharif Rice + Summer Rice + Summer Pulses (CS-II) followed by 49.38 per cent farmers, and iii) Kharif Rice + Kharif Vegetables + Summer Rice + Summer Pulses (CS-III) Followed by 16.04 per cent farmers. The input-use increased according to the cropping system followed. The per farm cost of cultivation was maximum in CS-III (Rs.265550) followed by CS-II (Rs.181459) and CS-I (Rs.98690). The per farm gross returns were also highest in CS-III (Rs.395388) followed by CS-II (Rs.170156) and CS-I (Rs.90925). The CS-I (Rs.-7765) and CS-II (Rs.-11303) were not profitable at cost 'C' level. However, CS-III gained per farm net profit of Rs.129838. The Benefit-Cost ratio was 0.92 in CS-I, 0.93 in CS-II and 1.48 in CS-III. This indicated that, in study area CS-I and CS-II were not economical and CS-III was found to be profitable.*

Keywords*: Cropping Systems, Irrigation, Cost, returns and Profitability.*

1. INTRODUCTION

Agriculture plays an important role in Indian economy. Agriculture production and efficiency largely depends on Irrigation which is associated with change in cropping pattern, use of improved technology and increase in per hectare yields. In Maharashtra, rainy season starts from June and end in September due to wide variations in its geographical distribution, such as ranging from over 3000 mm (Konkan region) to less than 700 mm. (Central Maharashtra – scarcity zone). In the Konkan region, although rainfall receives in *kharif* season (i.e. from June to October) is more than adequate for crop production. However, there is no water for crops in the rest of the period. The topography of the region is hilly and undulated and all water flows to the sea. Therefore, there is acute shortage of water not only for irrigation in summer. This speaks for the need for storage of rainwater. Due to hilly terrain, construction of irrigation projects is more difficult and costly. Therefore, The State Government has undertaken 'Kal' major irrigation project to create maximum irrigation potential in the Konkan region. Kal irrigation project is located in Roha tahsil and its command is restricted to Roha and Mangaon tahsils of Raigad district. The farmers in the command area use to put their land resource for cultivating two or more crops in year by adopting different cropping systems. This leads to change in cropping pattern as well as systems of command area. However, whether this change in cropping system is economically viable or not. Keeping this broad aspect, the present study was undertaken with the following specific objectives.

1. To identify existing cropping systems
2. To workout cost, returns and profitability of major cropping systems.

2. METHODOLOGY

For the present study, two stages stratified random sampling having selection of village is the first step and second step as a selection of respondents have been used. 15 farmers from each villages of various farm size were selected randomly. Thus the final sample consisted of 90 randomly selected farmers, 30 each from head reach, middle reach and tail reach. The data pertains to agricultural year 2012-13. The sample farmers were grouped as per the cropping systems, they have followed. The study focused on cost, returns and profitability of three major Cropping systems adopted by farmers with their input utilizations. The data collected from the selected farmers were analyzed separately for each cropping system, by using suitable mathematical and statistical techniques such as percentages, ratios, averages, frequency distribution etc. and standard cost concepts and cost- benefit.

3. RESULT AND DISCUSSION:

Existing Cropping Systems in study area

From the table, total nine cropping systems were followed by the sample farmers in study area. The existing cropping systems in study area were such as i) *Kharif* Rice + Summer

Rice (CS-I), ii) *Kharif* Rice + Summer Rice + Pulses (CS-II), iii) *Kharif* Rice + Vegetables + Summer Rice + Pulses (CS-III), iv) *Kharif* Rice + Summer Rice + Vegetables (CS-IV), v) *Kharif* Rice + Vegetables + Pulses + Summer Rice + Vegetables + Pulses + Mango (CS-V), vi) *Kharif* Rice + Summer Rice + Vegetables + Pulses + Groundnut (CS-VI), vii) *Kharif* Rice + Summer Rice + Pulses + Watermelon (CS-VII), viii) *Kharif* Rice + *Rabi* Pulses + Summer Rice + Watermelon (CS-VIII) and ix) Summer Rice (CS-IX).

Table: Existing Cropping Systems in study area.

Sr. No	Existing cropping systems	No. of farmers (N= 90)
1	Kharif Rice + Summer Rice + Pulses.	40 (44.45)
2	Kharif Rice + Summer Rice.	28 (31.12)
3	Kharif Rice + Vegetables + Summer Rice + Pulses.	13 (14.44)
4	Kharif Rice + Summer Rice + Vegetables.	3 (3.33)
5	Kharif Rice + Vegetables + Pulses + Summer Rice + Vegetables + Pulses + Mango.	2 (2.22)
6	Kharif Rice + Summer Rice + Vegetables + Pulses + Groundnut.	1 (1.11)
7	Kharif Rice + Summer Rice + Pulses + Watermelon.	1 (1.11)
8	Kharif Rice + Rabi Pulses + Summer Rice + Watermelon.	1 (1.11)
9	Summer Rice	1 (1.11)
	Total	90(100.00)

(Figures in parentheses are percentages to total)

Nikam (2005) in his study on economics of cropping systems in command area of Natuwadi irrigation project in Ratnagiri district revealed similar results.

Major cropping systems.

The cropping systems followed by more than 10 per cent farmers was considered to be the major cropping systems and further analysis was made as per the major cropping systems (CS-I, CS-II and CS-III).

Table: Major cropping systems adopted by the sample farmers.

Sr. No	Cropping systems	No of sample Farmers
1	Kharif Rice + Summer Rice (CS-I)	28 (34.56)
2	Kharif Rice + Summer Rice + Summer Pulses (CS-II)	40 (49.38)
3	Kharif Rice + Kharif Vegetables + Summer Rice + Summer Pulses (CS-III)	13 (16.04)
	Total	81 (100.00)

(Figures in parentheses are percentages to total)

It was observed from above table that, out of total (9) cropping systems followed in study area i) *Kharif* Rice + Summer Rice (CS-I), ii) *Kharif* Rice + Summer Rice + Pulses (CS-II) and iii) *Kharif* Rice + Vegetables + Summer Rice + Pulses (CS-III) were considered as major cropping systems.

Inputs utilizations in major Cropping Systems.

Per farm labour utilizations.

It was observed that, the per farm total labour utilization was maximum in CS-III (652.71 labour days) followed by CS-II (455.25 labour days) and CS-I (272.78 labour days). Among the various crops grown in different cropping systems, labour utilization was maximum in case of rice crop, because of all these cropping systems were rice based cropping systems.

Table: Per farm labour utilizations in major Cropping Systems.

Cropping Systems	Name of crop	Labour utilizations		
		HL (days)	BL (p. days)	ML (hrs.)
CS- I	Kharif Rice	141.06 (51.72)	7.12 (52.24)	10.31 (47.95)
	Summer Rice	131.72 (48.28)	6.51(47.76)	11.19(52.05)
	Total	**272.78 (100.00)**	**13.63 (100.00)**	**21.5 (100.00)**
CS- II	Kharif Rice	304.35 (66.85)	14.60 (58.47)	28.46 (79.38)
	Summer Rice	97.17 (21.35)	4.82 (19.30)	7.39 (20.62)
	Summer Wal	30.29 (6.65)	3.23 (12.94)	0.00 (0.00)
	Summer Green gram	23.44 (5.15)	2.32 (9.29)	0.00 (0.00)
	Total	**455.25 (100.00)**	**24.97 (100.00)**	**35.85 (100.00)**
CS- III	Kharif Rice	242.79 (37.19)	7.91 (35.91)	19.39 (44.94)
	Kharif Brinjal	222.64 (34.11)	0.00 (0.00)	15.12 (35.04)
	Summer Rice	117.02 (17.93)	6.09 (27.64)	8.64 (20.02)
	Summer Wal	40.68 (6.23)	5.14 (23.33)	0.00 (0.00)
	Summer Green gram	29.58 (4.54)	2.89 (13.12)	0.00 (0.00)
	Total	**652.71 (100.00)**	**22.03 (100.00)**	**43.15 (100.00)**

(Figures in parentheses are percentages to total)

The utilization of bullock labour (13.63 ploughing days, 24.97 ploughing day and 22.03 ploughing days) and machine labour (21.50 hrs, 35.85 hrs and 43.15 hrs) in CS-I, CS-II, and CS-III respectively.

Utilization of other inputs

Other than labour, seed, fertilizers, FYM, pesticides etc. are the important inputs used in the production of crop activity. The results were in conformity with Sharma *et al* (2012) in their study on resource use pattern, cost structure, returns and resource use efficiency of inputs used in cotton production in Hanumangarh tahsil of Rajasthan state. Utilization of maximum inputs and maximum employment was generated in CS-III, CS-II and CS-I. CS-I has minimum employment

generated because of only rice crop was cultivated in both the season. Similar results were also obtained by Saraswat (2005), in their study on economics of different irrigation systems in Hindu Kush Himalayas (Himachal Pradesh).

Sr. No	Inputs	Units	CS-I		CS-II				CS-III				
			Kharif Rice	Summer Rice	Kharif Rice	Summer Rice	Summer Wal	Summer Greengram	Kharif Rice	Khari f Brinjal	Summer Rice	Summer Wal	Summer Greengram
1	Human labour												
	Male	Days.	95.29	101.70	94.78	86.52	27.26	33.32	100.21	150.61	93.72	28.34	32.64
	Female	Days.	115.26	129.40	125.77	115.9	59.31	56.86	122.54	202.79	122.99	58.23	54.38
	Total		210.55	231.10	220.55	202.4	86.57	90.18	222.75	353.40	216.71	86.57	87.02
2	Bullock	P. days	10.63	11.43	10.58	10.05	9.23	8.94	7.26	0.00	11.29	10.94	8.52
3	Machinery	Hrs.	15.39	17.16	20.63	15.39	0	0	17.79	24	16.00	0.00	0.00
4	Seed	Kg.	51.24	62.37	52.18	60.85	46.27	44.27	51.95	0.88	61.70	47.38	47.98
5	FYM	Tonne.	4.89	6.67	5.7	5.5	4.01	4.3	5.64	15.43	6.52	7.18	9.17
6	Fertilizers												
	Urea	Kg.	100.13	120	113.22	118.6	53.45	55.31	110.37	210	120.32	55.50	54.45
	Mixed	Kg.	110	140	120.37	130	0.00	0.00	115	200	135.10	0.00	0.00
	SSP	Kg.			0.00	0.00	212	195.94	0.00	120	0.00	207.5	195
7	Plant Protection												
	Monocrotophos	Lit	-	-	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.75	0.00
	Dithane M-45	Kg.							0.00	1.80	0.00	0.00	0.00
8	Irrigation charges	Rs.	-	550	0.00	550	0.00	0.00	0.00	0.00	0.00	550	0.00	0.00

Table: Per hectare inputs used in Cropping Systems

Per farm cost and returns of major cropping systems.

The gross returns in CS-I, CS-II and CS-III was Rs.90925, Rs.170156 and Rs.395388, respectively. The per farm total cost incurred for cultivation of various crops in CS-I (Rs.98690), CS-II (Rs.181459) and CS-III (Rs.265550). The net returns at total cost in CS-I, CS-II and CS-III was Rs.-7765, Rs.-11303 and Rs.129838 resulting in to B: C ratio of 0.92, 0.93 and 1.48, respectively.

Table: Per farm cost and returns of major Cropping Systems.

Sr. No	Particulars	CS-I	CS-II	CS-III
1	Returns in Rs.			
	a) Main Product	78005	150062	377569
	b) By Product	12920	20094	17819
	c) Gross returns	90925	170156	395388
2	Costs			
	a) Cost 'A'	44569	85474	116025
	b) Cost 'B'	61292	117737	178015
	c) Cost 'C'	98690	181459	265550
3	Net Returns			
	a) At cost 'A'	46356	84682	279363
	b) At cost 'B'	29633	52419	217373
	c) At cost 'C'	-7765	-11303	129838
4	Benefit Costs Ratio	0.92	0.93	1.48

It was observed that, at cost 'C' CS-III was found to be only profitable cropping system as the net returns in other cropping systems (CS-I and CS-II) were negative. However, the CS-I and CS-II are followed by majority of farmers (83.94 %) though the net returns are negative at cost C. Per farm net returns at cost A and cost B were positive in both the cropping systems (CS-I and CS-II). The CS-III was found to be more remunerative which gives amount of Rs.129838 at total cost (cost 'C'). The farm income which is because of inclusion of brinjal, summer wal and summer green gram crops in addition to rice grown in *kharif* and *rabi* season. It was revealed that, more emphasis should be given for promoting the farmers to grow more area under vegetable crop, so that due to supply of irrigation the cropping pattern followed in the region can become more diversified and it will earn more income to the farmers. Inclusion of per farm net returns in CS-I, at cost A and cost B was Rs.46356 and Rs.29633, respectively. The per farm net returns in case of CS-II, at cost A and cost B were Rs.84682 and Rs.52419, respectively. Which indicate that, the CS-I and CS-II are profitable at cost A and cost B.

It was concluded that, the CS-III was more profitable than CS-I and CS-II. Similar results were also obtained by Vichare (2006) in her study on rice based cropping system in North

Konkan region of Maharashtra. Kinyau *et al.* (2003) studied economic analysis of rice legume rotation systems in Morogoro, Tanzania. Study revealed that, introduction of legumes is beneficial and sustainable leading to increased yield and income by more than 100 per cent. Thus, the inclusion of legumes in to rice cropping systems offers an ideal option for maximizing returns. Thus it can be concluded that, the rice based cropping system can be more beneficial due to inclusion of pulses. It was also concluded that, the vegetables plays an important role in improving the profitability of cropping systems. Hence, farmers should be advised to include vegetable crops in cropping system invariably.

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