

## Economic evaluation of sorghum based cropping systems

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### ABSTRACT

This study was conducted in Amravati and Bhatkuli Tahsils of Amravati district and five villages from each tahsil which were adopting sorghum based cropping systems. The data was collected for the year 2008-2009 from 24 cultivators for each system randomly. The ratio return over the investment at cost 'A' were 2.34, 2.58, 2.47, 2.42, 2.64 and at cost 'B', the ratio were 1.64, 1.85, 1.71, 1.68, 1.83 respectively for sole sorghum, sorghum + tur, sorghum + soybean, sorghum + cotton, sorghum + green gram. In case of sorghum + tur, the ratio at cost 'C' showed higher (*i.e.* 1.95) and lower in sole sorghum (*i.e.* 1.39). Thus, the study indicated that the sorghum + tur was found to be most profitable cropping system followed by sorghum + cotton cropping system.

### INTRODUCTION

Sorghum is the fifth most important cereal crop in the world. Increasing importance as a source of food, feed, industrial raw material and other like fibres are used in wall board fences, biodegradable packaging materials and solvents. The nutritional value of sorghum grains contain about 74.1 per cent starch, 11.2 per cent proteins, 37 per cent fats, 2.6 per cent crude fibre, 1.5 per cent ash and 0.1 per cent tanni. It is also used for preparation of syrups and penicilline medicine etc. The major states in the country where this cereal grain is produced are Maharashtra, Karnataka, Gujarat, Madhya Pradesh, Andhra Pradesh, Rajasthan and Uttar Pradesh.

Maharashtra ranks third in terms of area which covers around 48 lakh hectares with production of 3.90 million tones and productivity 760 kg/ha. during the year 2005-06. The major sorghum growing districts are Amravati, Akola, Yavatmal, Wardha, Nagpur, Bhandara, Chandrapur, Gadchiroli, Solapur, Pune, Bijapur, Nanded and Mehboob nagar. Sorghum is grown in Vidarbha on large scale and occupies third position in average and first position in production in the state with the advent of hybrid technology. In view of limited land, the increase in production can be achieved either by increasing the area under cultivation or through growing more than one crop on some pieces of land in the same year or in sequence. Adoption of proper cropping system can also be responsible for maintaining and improving

the soil fertility. Various sorghum based cropping systems are therefore emerged in the recent years. Cropping is commonly grouped under two broad terms *i.e.* inter cropping and intensive cropping. A major crop in particular agro-climatic zone dominates the system and hence it is based on that particular crop.

### METHODOLOGY

The data in respect of sorghum based cropping system adopted by the selected farmers from Amravati district were used for the study. The following sorghum based cropping system are generally followed in the study area namely Group I – Sole Sorghum, Group II – Sorghum + Tur, Group III – Sorghum + Soybean, Group IV – Sorghum + Cotton, Group V – Sorghum + Greengram. For the present study, five villages each from Amravati and Bhatkuli tahsils of Amravati district were selected purposively. From the list of cultivators of the above mentioned sorghum based cropping systems, 24 cultivators were selected randomly for each of the cropping system.

The data pertaining to family information, land use pattern, cropping pattern, livestock, implements and machinery etc. were collected for the year 2008-09. The information about input utilization and output of each cropping system have also been collected as per the requirement. The collected data were tabulated and analyzed by using the appropriate statistical tools and production function in order

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to accomplish an objective of the study. The standard cost concepts were used and cost benefit analysis was carried out from the selected cropping systems.

## RESULTS AND DISCUSSION

The adoption of new technology, though aims at increasing the production and income of the farmers require more capital investment. It is, therefore, necessary to make effort to reduce the cost of cultivation of crops and yield variability in dry farming. This can be achieved through adoption of appropriate cropping systems.

It is essential to study the average size of family to get an idea about labour force available for farm operations. The average size of family for the sample as a whole worked out was 6.01. The average number of males, females and children were at overall level 1.72 (28.62 per cent), 1.60 (26.62 per cent), 2.69 (44.75 per cent), respectively for the family ranged at various groups. At overall level 18.19 per cent were illiterate 24.19 per cent at Primary School, 37.05 per cent at High School, 16.72 per cent at junior college and 4.84 per cent above Junior College according to their educational level

distribution.

Table 1 shows that the average size of holding (*i.e.* net cultivated area) for the sample as a whole was 7.01 hectares. Fallow land at overall level was 6.15 per cent. Net cultivated area for a sample as a whole accounting for 93.84 per cent of the total land holding. The highest net cultivated area observed in group-IV (99.14 per cent) followed by group-III (95.82 per cent) followed by group-II (91.47 per cent) followed by group-V (90.56 per cent). The lowest net cultivated area was (85.42 per cent) in Group I.

Table 2 shows that the cropping pattern followed in the study area was diversified in nature. The gross cropped area for the sample as a whole was 7.01 hectare. The cropping intensity was observed highest in Group II followed by Group III. At overall level sorghum and cotton was the major crops accounted for 47.07 per cent and 24.54 per cent, respectively to the gross cropped area. Similar results have been obtained by Satpathy *et al.*, 2002; Dubey *et al.*, 1995; Chaudhari, 2009 and Wanjari *et al.*, 1994).

Table 3 shows that the Capital investment of selected

**Table 1 : Land utilization pattern of selected farmers for the year 2008-2009 (area in ha)**

Sr. No.	Particulars	Group I	Group II	Group III	Group IV	Group V	Overall
1.	Total land holding	4.39 (100)	10.78 (100)	5.02 (100)	12.90 (100)	4.24 (100)	7.47 (100)
2.	Fallow land	0.64 (14.57)	0.92 (8.53)	0.21 (4.18)	0.11 (0.85)	0.40 (9.44)	0.46 (6.15)
3.	Net cultivated area	3.75 (85.42)	9.86 (91.47)	4.81 (95.82)	12.79 (99.14)	3.84 (90.56)	7.01 (93.84)
4.	Irrigated area	-	0.04	0.02	-	0.02	-
5.	Area sown more than one	-	0.02	-	-	-	-
6.	Gross cropped area	3.75	9.88	4.81	12.79	3.84	7.01
7.	Cropping intensity	100	100	100	100	100	100

Note : Figures in parentheses indicates percentage to total land holding

**Table 2 : Cropping pattern followed by selected holding (area in ha)**

Sr. No.	Particulars	Group I	Group II	Group III	Group IV	Group V	Overall
1.	Sorghum	1.20 (32.00)	2.04 (20.64)	3.52 (73.18)	8.25 (64.50)	1.50 (39.06)	3.30 (47.07)
2.	Cotton	0.88 (23.47)	2.50 (25.30)	0.35 (7.27)	4.25 (33.23)	0.62 (16.14)	1.72 (24.54)
3.	Tur	0.60 (16.00)	1.86 (18.82)	0.44 (9.15)	0.29 (2.27)	0.34 (8.85)	0.70 (9.99)
4.	Soybean	0.77 (20.54)	2.02 (20.44)	0.48 (10.00)	-	0.70 (18.23)	0.79 (11.27)
5.	Greengram	0.30 (8.00)	1.40 (14.17)	-	-	0.66 (17.18)	0.47 (6.70)
6.	Wheat	-	0.04 (0.04)	-	-	0.02 (0.52)	0.012 (0.17)
7.	Gram	-	0.02 (0.02)	0.02 (0.41)	-	-	0.008 (0.11)
	Gross cropped area	3.75 (100.00)	9.88 (100.00)	4.81 (100.00)	12.79 (100.00)	3.84 (100.00)	7.01 (100.00)

Note : Figures in parentheses indicates percentage to gross cropped area

farmers were more on land accounting 71.18 per cent to total investment at overall level. In case of Group I Rs. 24428, Group II Rs. 45870, Group III Rs.44315, Group IV Rs. 53145, Group V Rs.30227, respectively. Fixed capital investment for group-I Rs.39543.15, Group-II, Rs.65360.25, Group-III, Rs.58988.91, Group-IV Rs.70677.21, Group-V Rs.43584.27. Thus per hectare capital investment was highest in sorghum + cotton followed by sorghum + tur and lowest in sole sorghum group. Similar results have been obtained by Naidu and Sivashankar (2007).

Input utilization for sorghum based cropping system revealed that the total human labour utilization was highest in sorghum + cotton group (119.11 days) cropping system followed by sorghum + tur (107.26 days) and lowest in sole sorghum (96.73 days). Highest hired human labour utilization was observed in sorghum + cotton (92.07 days) and lowest in sorghum + greengram (42.28 days). Highest family labour utilization in sorghum + greengram and lowest in sorghum + soybean cropping systems.

Highest bullock labours utilization was observed in sorghum + cotton followed by sorghum + soybean and lowest in case of sole sorghum group. The highest machinery was used by sorghum + soybean group 10.43 hrs. and lowest in sorghum + cotton 3.40 hrs.

Seed utilization was highest in sorghum + soybean 32.73 kg. and lowest in sorghum + cotton cropping system. The seed utilization differs according to crops grown.

Highest manure utilization was in sorghum + cotton 10.76 qtls. and lowest in sorghum + tur 3.49 qtls. Highest fertilizer utilization was observed in sorghum + cotton 118.60 kg and lowest in sorghum + greengram 55.09 kgs. Highest plant protection was observed in sorghum + tur cropping system and lowest in sorghum + cotton cropping system.

Table 4 shows that the total per hectare average cost of cultivation (Cast 'C') was highest *i.e.* Rs. 21707.14 for sorghum + cotton followed by sorghum + tur *i.e.* Rs. 10504.09 and lowest for sole sorghum *i.e.* Rs. 14198.28. Cost 'A' was found to be maximum in sorghum + cotton

**Table 3 : Capital investment of selected farmers**

Sr. No.	Particulars	Group I	Group II	Group III	Group IV	Group V	Overall
1.	Land	24428 (61.78)	45870 (70.18)	44315 (75.12)	53145 (75.19)	30227 (69.35)	39597 (71.18)
2.	Implements	1532.70 (3.87)	2124.89 (3.25)	2205.08 (3.73)	2325.90 (3.29)	1925.87 (4.41)	2022.9 (3.63)
3.	Livestock	1630.21 (4.12)	2713.37 (4.15)	1925.68 (3.26)	2418.31 (3.42)	1534.50 (3.52)	2045 (3.87)
4.	Farm building	11952.24 (30.22)	14652 (22.41)	10543.15 (17.87)	12788 (18.09)	9896.90 (22.70)	11966.45 (21.51)
	Total	39543.15 (100)	65360.25 (100)	58988.91 (100)	70677.21 (100)	43584.27 (100)	55630.76 (100)

Note : Figures in parentheses indicates percentage over total

**Table 4 : Per hectare production and returns from different sorghum based cropping systems**

Sr. No.	Particulars	Cropping systems				
		Group I	Group II	Group III	Group IV	Group V
1	<b>Production (q)</b>					
A)	Main produce	19.12	13.33+7.49	13.40+8.85	15.01+6.67	12.75+4.70
B)	By produce	35.19	22.16+4.68	22.22+3.70	33.34+3.52	18.66+2.05
2.	Total gross returns (Rs.)	19735.81	39879.74	30424.78	33988.10	27551.34
3.	<b>Total cost</b>					
	Cost 'A'	8458.31	11136.38	12283.62	14021.10	7554.45
	Cost 'B'	12011.48	18354.29	17717.50	20152.54	12551.50
	Cost 'C'	14198.28	19504.09	18753.50	21707.14	15913.10
4.	<b>Net return over</b>					
	Cost 'A'	11277.50	28743.36	18141.16	19967.00	1999.89
	Cost 'B'	7724.33	21525.45	12707.28	13835.56	14999.84
	Cost 'C'	5537.53	20375.65	11671.28	12280.96	11638.24
5.	<b>Input-output ratio</b>					
	Cost 'A'	2.34	2.58	2.47	2.42	2.64
	Cost 'B'	1.64	1.58	1.71	1.68	1.83
	Cost 'C'	1.39	1.95	1.62	1.56	1.73

(Rs. 14021.10) cropping system and lowest in sorghum + greengram (Rs. 7554.45). The rental value of land and hired human labours were found to be the major items of expenditure of all cropping systems.

It is seen from the Table 4 that the gross return worked out to be highest for sorghum + tur *i.e.* Rs. 39879.74 and lowest sole sorghum cropping system *i.e.* Rs. 19735.81. The examination of profitability of different cropping systems revealed that sorghum + tur cropping system is most profitable system followed by sorghum + cotton, sorghum + soybean, sorghum + greengram cropping system respectively. Sole sorghum cropping system is less profitable than based cropping systems.

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