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PROFITABILITY OF COARSE CEREALS PRODUCTION IN INDIA

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ABSTRACT

This study was aimed at investigating profitability of selected coarse cereals production in major producing states of India through analyzing cost, return and profitability of coarse cereals cultivation. Cost concepts and farm business income measures used for analysis the data ranging from 1980-81 to 2011-12. Net return of coarse cereals cultivation was observed to be highest for maize and it was highest in Bihar (Rs. 15,429/ha) and lowest Uttar Pradesh (Rs. -4,006/ha). Net return from cultivation of sorghum was found to be highest in Andhra Pradesh (Rs. 952/ha) and lowest for Madhya Pradesh (Rs. -1,456/ha). For pearl millet net return was highest in Andhra Pradesh (Rs. 4,995/ha) and lowest for Karnataka (Rs. -1,252/ha) whereas cultivation of finger millet was observed to be at a loss.

1. INTRODUCTION

Coarse cereals are group of crops that consists of all cereals except rice and wheat mainly maize, sorghum, pearl millet, barley, finger millet and small millets. These crops are grown in different parts of the world for different purposes mainly in the developing countries of Africa and Asia, which contribute more of area but less of production due to low productivity. These countries are also home for the majority of poor, malnourished and food insecure. Grown in the marginal land with minimum input, coarse cereals gained popularity and higher acceptability by the hundreds of millions of subsistence farmers. They also have the potential to improve the food and nutritional security of the world poor since they are more nutritious than the superior cereals. They are rich in nutrients, minerals and vitamins and less in carbohydrate and gluten free nature of these crops also brought about shift in the consumption pattern in the calorie conscious life style.

In addition to coarse cereals' food value and benefits, they are currently being used for different industrial uses including biofuel for the ever increasing demand and alternative sources of safer energy. Moreover, the increasing demand of meat and dairy products in the world has also resulted in more demand of coarse cereals for feed. The multiple uses of these crops have also brought about increase in the demand.

India is on the top list of coarse cereals producers in the world in terms of area and production. Coarse cereals had been traditionally the main components of the food basket of the poor in India. However, it is now considered as one of the neglected crop sectors. These are predominantly grown in the resource fragile agro climatic regions of the country mainly in Karnataka, Maharashtra, Tamil Nadu, Madhya Pradesh, Rajasthan and Gujarat. In addition to agricultural allied sectors' demand, it offers a good potential in food processing industry and as a promising exportable commodity. The acreage under coarse cereals has declined. Despite area decline, the production of coarse cereals has increased now as compared to eighties. Maize is one of the major coarse cereals, and its production has increased in particular. Such production increase has been demanded driven from livestock sector. But the performance of other coarse cereals continues to be dismal. The poor production performances and relative profitability of other coarse cereals like pearl millet, sorghum, finger millet, and millets are little studied of late. With this back drop, this study is aimed at investigating profitability of selected coarse cereals in major producing states of India.

2. DATA AND METHODOLOGY

The study is based on secondary data during time period (1980-81 to 2011-12), which is collected from various published sources. Data on costs and farm harvest prices of major coarse cereals in India were collected from Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. For the analysis of cost and returns of the selected coarse cereals in major coarse cereals producing states, costs concept and farm business income measures were used.

Cost concept

1. **Cost A_1**: It includes all actual expenses in cash and kind incurred in production by the farmer.
   - i) Value of hired human labour
   - ii) Value of bullock labour (both hired and owned)
   - iii) Value of machine power (both hired and owned)
   - iv) Value of seeds (both owned and purchased)
   - v) Value of insecticides and pesticides, weedicides
   - vi) Value of manures (both owned and purchased)
   - vii) Value of fertilizers
   - viii) Depreciation of implements and farm buildings
   - ix) Irrigation charges
   - x) Land revenue, cess and other taxes
   - xi) Miscellaneous expenses (electricity charges etc)
   - xii) Interest on working capital
2. **Cost A_2 :**Cost A_1 + rent paid for leased in- land
3. **Cost B_1**: Cost A_2 + interest on value of owned capital assets (excluding land)
4. **Cost B_2**: Cost B_1 + rental value of owned land
5. **Cost C_1**: Cost B_1 + imputed value of family labour
6. **Cost C_2**: Cost B_2 + imputed value of family labour
7. **Cost C_2 revised**: Cost C_2 x 1.10 (10% of cost C_2 is added to cost C_2) : this is a recently added concept to provide allowance for managerial functions undertaken by the farmer. It is the total cost or comprehensive cost of cultivation.

Cost of production = (Cost C_2) / Yield

Interest on present value of fixed capital assets charged at the rate of 10% per annum. Interest on working capital is charged at the rate of capital 12.5% per annum for half the period of crop.

Farm business income measures:

1. **Gross returns:** Value of main product plus by-product.
2. **Net income** = Gross return-Cost C_2 revised
3. **Net return to Cost A_2** = Gross return - Cost A_2
4. **Net return to C_2** = Gross return - Cost C_2
5. **Profitability** = Net return / Cost
6. **Benefit Cost Ratio (BCR)** = Gross Return / Total Cost

3. RESULTS AND DISCUSSION

3.1. Profitability of Maize Production in India

Maize is one of the major coarse cereal crop in the country. Cost and return of maize varies in states of India were analysed and it was found that the average cost of cultivation of maize was highest in Andhra Pradesh,Rs. 26,563/ha, of which variable cost and fixed cost were 65% and 35% respectively. It was observed to be lowest in Madhya Pradesh,Rs. 9,340/ha, of which variable cost formed about 73%. The expenditure on human labour was a major component in variable cost in all the states. Similarly, rental value of the land formed major component among fixed costs in TE 2010-11. Human labour requirement was highest in Andhra Pradesh,647.11 man hours per hectare followed by Rajasthan, 619.42 man hours per hectare and lowest in Madhya Pradesh, 416.32 man hours per hectare. Chemical fertilizer used was highest in Andhra Pradesh, 221kg/ha and lowest in

Madhya Pradesh, 43kg/ha. Irrigation charge was found to be highest in Bihar (Rs. 2,090/ha) followed by Andhra Pradesh(Rs. 1,067/ha).

Gross return of maize cultivation was observed to be highest in Bihar, Rs. 29,959/ha followed by Andhra Pradesh (Rs. 27,840/ha) and lowest in Madhya Pradesh, Rs. 7261/ha. Net return from cultivation of maize was highest in Bihar (Rs. 15,429/ha) but negative in Uttar Pradesh(Rs.-4,006/ha) and Madhya Pradesh (Rs. -2,079/ha). Benefit cost ratio (BCR) was also highest in Bihar (2.06) but lowest in Uttar Pradesh (0.73) and Madhya Pradesh (0.78). Even though yield was highest in Andhra Pradesh (46 qt/ha), BCR was observed to be low due to high cost of cultivation from input intensive production and high cost of human labour. In Madhya Pradesh, BCR was less than one due to high cost of production and low yield (11qt/ha). In Bihar, high yield coupled with low cost of human labour resulted in highest BCR (Table - 1).

In Bihar, over the years 1996-97 to 2010-11 the net return over A_2 from maize has increased by about 11% per annum due to about 7% per year increase in gross return. The increase in gross return was mainly due to annual increase of productivity by 5.57% as the increase in real price of maize was only 1.04%. More over the increase in yield has resulted in increase in the cost of production by only 1.34% annually. The scenario in Uttar Pradesh has been different from Bihar. Net return in Uttar Pradesh has shown a marginal increase over the years (0.3%) due to higher increase in cost of cultivation (4.29%) than gross return (3.05%). The increase in yield was only about 2% per year so that cost of production has increased by about 2%. In the same manner BCR of maize in Bihar has increased (4.7% per year) while it has decreased in Uttar Pradesh (-1.18% per year) (Table-2).

3.2 Profitability of Sorghum Production in India

State wise cost and return estimate of sorghum was done based on data during the time period TE 2010-11. The average cost of cultivation of sorghum was found to be highest in Andhra Pradesh (Rs. 15,569/ha) and lowest in Rajasthan (Rs. 6,209/ha). Among the variable inputs, human labour was observed to be the highest in Maharashtra (519 man hrs) and lowest in Rajasthan (298 man hrs). Gross return was highest in Andhra Pradesh (Rs. 16,521/ha) and lowest in Rajasthan (Rs. 6,133/ha). Net return and BCR of Andhra Pradesh were Rs. 952/ha and 1.06 respectively, which were observed to be the highest. In Madhya Pradesh, sorghum production was at a loss of Rs. -1,456/ha and BCR of 0.83. The lowest BCR in Madhya Pradesh could be due to low productivity (11 qt/ha) along with lower remunerative price (Table - 3).

Gross return and cost of cultivation from sorghum over the period 1999-2000 to 2010-11 has increased for both Maharashtra and Andhra Pradesh but were higher for the latter. The net return from A_2 has increased for Andhra Pradesh (14% per year) than for Maharashtra (3.21% per year) due to increase in real price of sorghum in Andhra Pradesh (5.89%) but lesser increase in Maharashtra (1.66%). Therefore, BCR of sorghum cultivation has increased at a rate of 3.43% in Andhra Pradesh but only 0.33% per year for Maharashtra (Table - 4).

3.3 Profitability of Pearl millet Production in India

Cost and return analysis was undertaken for pearl millet, another important cereal crop. Production of pearl millet observed to be input intensive in Gujarat as compared to other states with high level of chemical fertilizer and human labour. Cost of cultivation of pearl millet was observed to be highest in Maharashtra (Rs. 15,181/ha) and lowest in Karnataka (Rs. 5,749/ha). Gross return from cultivation of pearl millet was highest in Gujarat (Rs. 18,115/ha) and lowest in Karnataka (Rs. 4,497/ha).Net return over C_2 and BCR were also highest in Gujarat and lowest in Karnataka. The change in net return might be due to regional variation in productivity and price of output among the states (Table - 5).

Table 1: Cost and return of maize in selected states of India in TE2010-11

Particulars	Andhra Pradesh		Bihar		Karnataka		Madhya Pradesh		Rajasthan		Uttar Pradesh	
	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent
Operational Cost	17270	65.01	10035	71.33	9850	67.51	6795	72.75	10826	71.22	10076	66.97
Fixed Costs	9293	34.99	4034	28.67	4740	32.49	2545	27.25	4374	28.78	4969	33.03
Total Cost	26563	26563	14070		14590		9340		15199		15045	
Gross return (Rs./ha)	27840		29959		18892		7261		15641		11040	
Cost A_2 (Rs/ha)	15021		8696		8121		4434		7333		6530	
Net return over A_2 (Rs/ha)	12819		21263		10771		2827		8308		4510	
Profitability (Net return as % of A_2)		85.34		244.53		132.64		63.74		113.3		69.07
Cost C_2 (Rs/ha)	26657		14530		14869		9340		15223		15045	
Net return over C_2 (Rs/ha)	1183		15429		4023		-2079		418		-4006	
Profitability (Net return as % of C_2)		4.44		106.19		27.06		-22.26		2.74		-26.62
Productivity (qt/ha)	46		38		31		11		20		17	
Gross return (Rs/qt)	605		788		603		654		802		660	
Cost of production (C_2) (Rs/qt)	552		329		429		673		576		807	
BCR	1.04		2.06		1.27		0.78		1.03		0.73	

Author's calculation based on data from DES, GOI

Table 2: Cost and return of maize in selected states of India

Year (TE)	Bihar							Uttar Pradesh						
	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR
1998-99	13628	6653	6975	20.59	575	666	2.05	7889	3587	4302	12.69	553	285	2.20
2001-02	11910	7660	4250	22.93	456	519	1.55	8437	4848	3589	16.14	481	300	1.74
2004-05	17951	7909	10042	34.63	461	519	2.27	8351	4347	4004	13.22	572	337	1.92
2007-08	19181	8264	10917	36.94	454	520	2.32	10035	4961	5073	17.61	499	285	2.02
2010-11	29959	8696	21263	38.00	654	792	3.45	11040	6530	4510	16.72	575	402	1.69
CAGR (%)	6.99	2.19	10.89	5.57	1.04	1.34	4.7	3.05	4.29	0.3	2.32	0.49	1.92	-1.18
CV (%)	36.95	10.8	59.17	25.95	18.5	21.74	29.8	19.4	27.14	35.27	19.31	13.12	24.28	20.02

Author's calculation based on data from DES, GOI

Table 3: Cost and return of sorghum in selected states of India in TE2010-11

Particulars	Andhra Pradesh		Karnataka		Madhya Pradesh		Maharashtra		Rajasthan		Tamil Nadu	
	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent
Operational Cost	9675	62.14	5156	70.62	5889	70.03	8958	67.79	4480	72.15	5819	77.26
Fixed Costs	5894	37.86	2145	29.38	2520	29.97	4256	32.21	1729	27.85	1713	22.74
Total Cost	15569		7301		8410		13214		6209		7532	
Gross return (Rs./ha)	16521		6993		6954		13684		6133		7737	
Cost A_2 (Rs/ha)	7910		4185		4325		7660		2340		4532	
Net return over A_2 (Rs/ha)	8612		2808		2629		6024		3792		3205	
Profitability (Net return as % of A_2		108.88		67.11		60.78		78.64		162.06		70.71
Cost C_2 (Rs/ha)	15569		7301		8410		13214		6209		7532	
Net return over C_2 (Rs/ha)	952		-308		-1456		470		-76		205	
Profitability (Net return as % of C_2)		6.12		-4.22		-17.31		3.56		-1.23		2.72
Productivity (qt/ha)	16		8		11		13		5		8	
Gross return (Rs/qt)	1028		894		621		1044		1355		997	
Cost of production (C_2) (Rs/qt)	892		782		596		660		571		606	
BCR	1.06		0.96		0.83		1.04		0.99		1.03	

Author's calculation based on data from DES, GOI

Table 4: Cost and return of sorghum in selected states of India

Year (TE)	Maharashtra							Andhra Pradesh						
	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR
2001-02	11767	8205	3562	12.93	589	641	1.43	8264	6723	2771	10.76	665	616	1.23
2004-05	13058	7437	5621	12.56	655	596	1.76	9526	6572	2954	11.49	734	586	1.45
2007-08	12646	8074	4572	15.26	552	536	1.57	9240	6172	3068	12.73	610	491	1.50
2010-11	13685	7660	6024	13.10	682	587	1.79	16521	7910	8612	16.08	949	509	2.09
CAGR (%)	2.25	1.91	3.21	0.31	1.66	0.24	0.33	7.1	3.55	14	0.79	5.89	-1.24	3.43
CV (%)	14.17	19.06	32.42	13.07	15.02	18.35	15.14	38	24.12	73.18	15.17	29.02	23.23	24.39

Author's calculation based on data from DES, GOI

Over the period 1999-2000 to 2010-11, gross return from cultivation of pearl millet has increased for Gujarat (3.43%) and Rajasthan (2.89%) coupled with increase in the growth rate of cost of cultivation at a rate of 1.51% for Gujarat and 3.44% for Rajasthan. A marginal increase in real price of produce and more than 2.5% increase in yield resulted in increase of net return and decline in cost of production in Gujarat. As a result, the BCR of pearl millet cultivation has declined marginally for Rajasthan at a rate of -0.53% but for Gujarat increased at a rate of 1.89% per year (Table - 6).

3.4 Profitability of Finger millet Production in India

The profitability analysis of finger millet has shown that it is not a profitable crop overall. The operational cost of finger millet observed to be highest in Maharashtra (Rs. 16,626/ha) and was around 75% of total cost of cultivation. Among the variable costs, the share of human labor was observed to be more than 40% for all the states taken in to consideration showing labour intensive production of finger millet. BCR of finger millet cultivation was highest in Tamil Nadu (1.26) due

to higher yield and price of produce but was low in Maharashtra (0.63) due to higher cost of production mainly human labour (Table - 7).

Over the period 1999-2000 to 2010-11, gross return from finger millet has shown an increase for both the states of Tamil Nadu (4.53% per annum) and Karnataka (3.80% per annum) but cost of cultivation has declined at a rate of -3.5% per annum for Tamil Nadu while has increased at a rate of 2.09% for Karnataka. Yield of finger millet has increased at 4.41% per annum for Tamil Nadu but only 1.62% was seen in Karnataka. However, real price has increased for the latter and marginally declined for the former. As a result, net return from finger millet cultivation has shown impressive growth in Tamil Nadu (20.12%) and 8.04% per year for Karnataka. More over cost of production has declined (-7.58%) and BCR increased by 8.32% in Tamil Nadu (Table - 8).

Table 5: Cost and return of pearl millet in selected states of India in TE2010-11

Particulars	Gujarat		Haryana		Karnataka		Maharashtra		Rajasthan		Uttar Pradesh	
	Value (Rs.)	percent	Value (Rs.)	percent	Value (Rs.)	Percent	Value (Rs.)	percent	Value (Rs.)	percent	Value (Rs.)	percent
Operational Cost	9376	71.46	7989	61.69	4387	76.32	10980	72.33	4817	68.97	7237	60.14
Fixed Costs	3744	28.54	4961	38.31	1361	23.68	4201	27.67	2167	31.03	4796	39.86
Total Cost	13120	100	12950	100	5748	100	15181	100	6983	100	12032	100
Gross return (Rs./ha)	18115		12399		4497		14045		8068		11096	
Cost A_2 (Rs/ha)	7338		4528		3573		8858		2361		4740	
Net return over A_2 (Rs/ha)	10777		7871		924		5188		5707		6356	
Profitability (Net return as % of A_2)		146.86		173.85		25.85		58.57		241.7		134.1
Cost C_2 (Rs/ha)	13120		12950		5748		15181		6983		12032	
Net return over C_2 (Rs/ha)	4995		-551		-1252		-1136		1085		-936	
Profitability (Net return as % of C_2)		38.07		-4.26		-21.77		-7.48		15.53		-7.78
Productivity (qt/ha)	21		19		8		19		9		20	
Gross return (Rs/qt)	860		661		542		739		867		558	
Cost of production (C_2) (Rs/qt)	451		553		642		638		432		476	
BCR	1.38		0.96		0.78		0.93		1.16		0.92	

Author's calculation based on data from DES, GOI

Table 6: Cost and return of pearl millet in selected states of India

Year (TE)	Gujarat							Rajasthan						
	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR
2001-02	12583	6401	6181	15.35	589	419	1.97	5221	1829	3392	7.12	427	263	2.85
2004-05	12151	7172	4979	15.84	560	453	1.69	8481	2305	6176	9.16	531	266	3.68
2007-08	14440	7422	7017	18.25	593	407	1.95	6406	2228	4178	7.73	534	298	2.87
2010-11	18115	7338	10777	21.07	602	349	2.47	8068	2361	5707	9.31	495	261	3.42
CAGR (%)	3.43	1.51	5.21	2.87	0.16	-1.33	1.89	2.89	3.44	2.68	2.53	0.72	0.89	-0.53
CV (%)	18.4	10.3	31.79	16.5	5.99	10.62	15.11	22.22	16.7	27.6	24	16.64	20.31	17.15

Author's calculation based on data from DES, GOI

Table 7: Cost and return of finger millet in selected states of India in TE 2010-11

Particulars	Karnataka		Maharashtra		Tamil Nadu	
	Value (Rs.)	Percent	Value (Rs.)	Percent	Value (Rs.)	Percent
Operational Cost	11279	71.66	16626	75.58	10888	75.43
Fixed Costs	4461	28.34	5371	24.42	3547	24.57
Total Cost	15740		21997		14434	
Gross return (Rs./ha)	12519		13963		18234	
Cost A_2 (Rs/ha)	8770		13177		7156	
Net return over A_2 (Rs/ha)	3749		787		11078	
Profitability (Net return as % of A_2)		42.74		5.97		154.8
Cost C_2 (Rs/ha)	15740		21997		14434	
Net return over C_2 (Rs/ha)	-6970		-8820		-7278	
Profitability (Net return as % of C_2)		-44.28		-40.1		-50.42
Productivity (qt/ha)	16		18		25	
Gross return (Rs/qt)	804		786		737	
Cost of production (C_2) (Rs/qt)	787		1157		534	
BCR	0.8		0.63		1.26	

Author's calculation based on data from DES, GOI

Table 8: Cost and return of finger millet in selected states of India

Year (TE)	Tamil Nadu							Karnataka						
	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR	Gross return (Rs./ha)	Cost A_2 (Rs/ha)	Net return over A_2 (Rs./ha)	Productivity (qt/ha)	FHP (Rs/qt)	Cost of production (Rs/qt)	BCR
2001-02	12490	9061	3429	18.00	628	504	1.38	9062	9140	-78	15.71	460	605	0.99
2004-05	10499	6875	3624	13.47	763	580	1.53	8056	6185	1870	10.70	520	579	1.30
2007-08	17106	6480	10626	25.10	607	274	2.64	11636	9488	2148	15.83	580	607	1.23
2010-11	18234	7156	11078	24.73	670	302	2.55	12519	8770	3749	15.57	615	567	1.43
CAGR (%)	4.53	-3.5	20.12	4.41	-0.04	-7.58	8.32	3.8	2.09	8.04	1.62	1.74	-0.8	2.08
CV(%)	32.65	23.81	75.82	34.95	16.43	48	39.47	22.84	16.37	82.5	20.52	15.17	15.3	20.6

Author's calculation based on data from DES, GOI

3.2 Profitability of Competing Crops of Coarse Cereals in India

The competing crops for the different coarse cereals in different states of India varied. In general, the competing crops for the coarse cereals are mainly pulses and oil seeds. In some part of the country coarse cereals have also faced competition with other crops like cotton and sugarcane. Besides, coarse cereals have also competed with each other.

Maize competes with paddy in Bihar, Punjab and Uttar Pradesh; with soybean in Madhya Pradesh; with groundnut in Rajasthan (Kumar *et al., 2004).* Sorghum is competing with cotton, green gram and groundnut in Madhya Pradesh (Basavaraja *et al.,* 2005). Sorghum and maize are competing with soybean in Madhya Pradesh (Jaiswal and Hugar, 2011). Cotton, groundnut, pulses and castor are the major crops replacing sorghum in many areas. Soybean is the competing crop, especially in central and western India replacing sorghum. Cotton, sunflower, maize, groundnut, pulses and soybean are replacing pearl millet (CFC and ICRISAT, 2004).

In Bihar, BCR of maize was 3.44 in TE 2010-11 but for paddy it was 1.98. In Uttar Pradesh, it was 1.69 for maize and 2.57 for paddy. In Madhya Pradesh,BCR of maize was 1.64 but that of soybean was 2.59. Moreover, net return from maize cultivation was more than threefold than that of paddy in Bihar but less than one third in Uttar Pradesh.

Sorghum scored BCR of 1.79 in Maharashtra and 2.09 in Andhra Pradesh, 1.67 in Karnataka while maize scored 1.85 in Andhra Pradeshand cotton scored 1.52 and gram 1.28 in Madhya Pradesh.In Rajasthan BCR of sorghumwas2.62 while that of cotton was 5.98 and 3.19 for gram. Net return from sorghum cultivation was observed to be about 12% of that of cotton in Madhya Pradeshand around 11% in Rajasthan.

In Gujarat, BCR of pearl millet was 2.47 and 1.98 for groundnut and 2.96 for cotton whereas in Rajasthan BCR of pearl millet was 3.42 and that of green gram was 3.52. Net return from pearl millet cultivation was about one third of cotton in Gujarat and only about 16% in Rajasthan. BCR of finger millet was 2.55 and 2.24 for cotton in Tamil Nadu. In Karnataka it was 1.43 but 2.53 for sugarcane (Appendix - 1).

4. CONCLUSIONS

The study revealed that net return from cultivation of maize was highest in Bihar and lowest in Madhya Pradesh. BCR was also highest in Bihar followed by Karnataka but lowest in Uttar Pradesh. Even though yield was highest in Andhra Pradesh,highest cost of cultivation from input intensive nature of production, BCR was observed to be low.

In Madhya Pradesh BCR was low due to high cost of production and low yield. In Bihar, high yield coupled with low cost of human labour resulted in highest BCR of maize. The cost of cultivation of sorghum was highest in Andhra Pradeshand lowest in Rajasthan. Among the variable inputs, human labour cost was highest in Maharashtra and lowest in Rajasthan. Net return and BCR were highest inAndhra Pradeshand Rajasthan respectively. Lowest BCR observed inMadhya Pradesh was due to low productivity and higher BCR in Rajasthan was due to low cost of cultivation. Cost of cultivation of pearl millet was observed to be highest in Maharashtra and lowest in Rajasthan. Net return was highest in Gujarat and BCR was highest in Rajasthan. Both Net return and BCR were lowest in Karnataka due to low productivity and price of produce.BCR of finger millet cultivation was highest in Tamil Nadu due to higher yield and price of produce but was low in Maharashtra due to higher cost of production mainly human labour. Net return from finger millet cultivation was highest in Tamil Nadu.

Profitability analysis has revealed that, It was observed that there are regional disparities with respect to specific crops of coarse cereals in the country. Net return from A_2 for maize was highest in Bihar (Rs. 21,263/ha), for sorghum in Andhra Pradesh (Rs. 8,612/ha), for pearl millet in Gujarat (Rs. 10,777/ha) and for finger millet it was highest in Tamil Nadu (Rs. 11,078/ha) while BCR of maize from A_2 was highest in Bihar (3.44), for sorghum and pearl millet in Rajasthan (2.62 and 3.42 respectively) and for finger millet in Tamil Nadu (2.55). In Bihar over the years the net return from maize has increased due to increase in gross return. The increase in gross return was mainly due to

increase in productivity. Moreover, the increase in yield has resulted in decline in the cost of production but in Uttar Pradesh net return has shown only a marginal increase due to higher increase in cost of cultivation than gross return and lower increase in yield. BCR in Bihar has increased while it has decreased in Uttar Pradesh. Gross return and cost of cultivation from sorghum has increased in both Maharashtra andAndhra Pradesh. The increase in yield was lower inAndhra Pradeshresulted in increase in cost of production but marginal decline of cost of cultivation in Maharashtra. The net return has increased for Andhra Pradesh than Maharashtra due to higher increase in real price of sorghum in Andhra Pradesh. Gross return from cultivation of pearl millet has increased in Gujarat and Rajasthan. In Rajasthan the increase in gross return was coupled with increase in cost of cultivation. Hence, BCR of pearl millet cultivation has declined in Rajasthan while net return from cultivation of pearl millet has increased with increase in cost of production in Gujarat. Gross return from finger millet has increased in both Tamil Nadu and Karnataka. However, cost of cultivation has declined in Tamil Nadu while it has increased in Karnataka. Yield of sorghum has increased in Tamil Nadu but marginal increase in Karnataka. With real price has increased for the latter and marginally declined for the former, the net return from finger millet cultivation has shown growth in Tamil Nadu and Karnataka. The cost of production has declined and BCR increased in Tamil Nadu.

The economic profitability analysis between major coarse cereals and competing crops in the major producing states revealed that in Bihar BCR of maize was higher than paddy and in Madhya PradeshBCR of maize was lower than soybean. In Uttar Pradesh BCR of maize was lower than paddy. BCR of sorghum was lower than maize in Karnataka and in Madhya Pradesh. In Rajasthan, BCR of sorghum was lower than that of pearl millet, cotton and gram. In Gujarat, BCR of pearl millet was lower than cotton whereas in Rajasthan BCR of pearl millet was higher than groundnut. BCR of finger millet was higher than sorghum and groundnut in Tamil Nadu.

The study revealed that the gain or loss of area for the studied coarse cereals related to relative profitability of these crops against their competitors. Since net return from maize cultivation was higher in Bihar than paddy and gram, in Karnataka against sorghum and finger millet and in Andhra Pradesh against sorghum, area under maize has increased for these states but in Uttar Pradeshmaize has lost area due to lower net return against paddy. The loss of area for sorghum was the highest among the major coarse cereals in Andhra Pradesh and Madhya Pradesh due to higher net return from cultivation of its competing crops, maize in Andhra Pradesh and soybean in Madhya Pradesh. Area and net return of pearl millet has declined in Gujarat but it has increased in Rajasthan and its net return was observed to be higher than groundnut in Rajasthan. Moreover, area of finger millet has declined both in Tamil Nadu and Karnataka even though net return from its cultivation has increased due to even higher increase in net return of maize so that finger millet area has declined.

Appendix 1: Cost and return of coarse cereals and competing crops in selected states of India in TE 2010-11

Crop	Particular	AP	Bihar	Gujarat	Karnataka	MP	Maharashtra	Rajasthan	TN	UP
Maize	Gross return (Rs./ha)	27840	29959		18892	7261		15641	29841	11040
	Cost A_2 (Rs/ha)	15021	8696		8121	4434		7333	13632	6530
	Net return over A_2 (Rs/ha)	12819	21263		10771	2827		8308	16209	4510
	Profitability (Net return as % of A_2)	85.34	244.53		132.64	63.74		113.3	118.90	69.07
	Productivity (qt/ha)	46.00	38.00		31.31	11.10		19.50	46.56	16.72
	BCR	1.85	3.44		2.33	1.64		2.13	2.19	1.69
Sorghum	Gross return (Rs./ha)	16521			6993	6954	13684	6133	7737	
	Cost A_2 (Rs/ha)	7910			4185	4325	7660	2340	4532	
	Net return over A_2 (Rs/ha)	8612			2808	2629	6024	3792	3205	
	Profitability (Net return as % of A_2)	108.88			67.11	60.78	78.64	162.06	70.71	
	Productivity (qt/ha)	16.08			7.82	11.19	13.10	4.53	7.76	
	BCR	2.09			1.67	1.61	1.79	2.62	1.71	
Pearl millet	Gross return (Rs./ha)			18115	4497		14045	8068		11096
	Cost A_2 (Rs/ha)			7338	3573		8858	2361		4740
	Net return over A_2 (Rs/ha)			10777	924		5188	5707		6356
	Profitability (Net return as % of A_2)			146.86	25.85		58.57	241.7		134.1
	Productivity (qt/ha)			21.07	8.30		19.01	9.31		19.89
	BCR			2.47	1.26		1.59	3.42		2.34
Finger millet	Gross return (Rs./ha)				12519		13963		18234	
	Cost A_2 (Rs/ha)				8770		13177		7156	
	Net return over A_2 (Rs/ha)				3749		787		11078	
	Profitability (Net return as % of A_2)				42.74		5.97		154.8	
	Productivity (qt/ha)				15.57		17.76		24.73	
	BCR				1.43		1.06		2.55	
Paddy	Gross return (Rs./ha)	37914	13636	31911	34456	19386	21454		33428	24346
	Cost A_2 (Rs/ha)	18264	7103	12660	14945	6952	17956		18372	9477

Crop	Particular	AP	Bihar	Gujarat	Karnataka	MP	Maharashtra	Rajasthan	TN	UP
	Net return over A_2 (Rs/ha)	19650	6533	19251	19510	12434	3499		15055	14870
	Profitability (Net return as % of A_2)	107.59	91.98	152.06	130.54	178.86	19.48		81.95	156.91
	Productivity (qt/ha)	54.43	21.64	39.28	47.26	23.80	25.65		47.09	37.23
	BCR	2.08	1.92	2.52	2.31	2.79	1.19		1.82	2.57
Cotton	Gross return (Rs./ha)	33882		46061	23836	29221	29131	41588	38502	
	Cost A_2 (Rs/ha)	14951		15539	9679	7940	15759	6959	17173	
	Net return over A_2 (Rs/ha)	18932		30521	14158	21281	13372	34629	21330	
	Profitability (Net return as % of A_2)	126.63		196.41	146.27	268.04	84.85	497.61	124.21	
	Productivity (qt/ha)	16.87		19.93	10.39	14.47	13.43	17.73	19.64	
	BCR	2.27		2.96	2.46	3.68	1.85	5.98	2.24	
Ground nut	Gross return (Rs./ha)	24716		26080	11890		26888		22205	
	Cost A_2 (Rs/ha)	14542		13192	7946		14298		12376	
	Net return over A_2 (Rs/ha)	10174		12888	3945		12591		9830	
	Profitability (Net return as % of A_2)	69.96		97.70	49.64		88.06		79.43	
	Productivity (qt/ha)	14.92		12.57	5.64		15.01		12.35	
	BCR	1.70		1.98	1.50		1.88		1.79	
Gram	Gross return (Rs./ha)	21254	21384		11975	15100	13815	12360		17564
	Cost A_2 (Rs/ha)	10400	5988		6365	5842	7568	3872		6452
	Net return over A_2 (Rs/ha)	10854	15396		5610	9258	6247	8487		11112
	Profitability (Net return as % of A_2)	104.37	257.13		88.14	158.48	82.55	219.18		172.22
	Productivity (qt/ha)	14.2	14.06		8.41	10.63	8.84	7.52		10.83
	BCR	2.04	3.57		1.88	2.58	1.83	3.19		2.72
Moong	Gross return (Rs./ha)	7267			4142		10166	6792		
	Cost A_2 (Rs/ha)	2304			2720		5762	1927		
	Net return over A_2 (Rs/ha)	4964			1422		4404	4865		
	Profitability (Net return as % of A_2)	215.48			52.31		76.43	252.50		
	Productivity (qt/ha)	4.40			2.23		6.42	3.54		
	BCR	3.15			1.52		1.76	3.52		
Soybean	Gross return (Rs./ha)					20249	18508	14279		
	Cost A_2 (Rs/ha)					7809	12616	6978		
	Net return over A_2 (Rs/ha)					12439	5892	7301		
	Profitability (Net return as % of A_2)					159.29	46.70	104.64		
	Productivity (qt/ha)					13.87	12.45	8.34		
	BCR					2.59	1.47	2.05		
Sugar cane	Gross return (Rs./ha)				42606		39145			
	Cost A_2 (Rs/ha)				16859		21097			
	Net return over A_2 (Rs/ha)				25747		18047			
	Profitability (Net return as % of A_2)				152.72		85.54			
	Productivity (qt/ha)				334.97		258.87			
	BCR				2.53		1.86			

Author's calculation based on data from DES, GOI

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