

Growth Performance and Economic Feasibility of Kharif Maize vis-à-vis Paddy Basmati Cultivation in Haryana

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ABSTRACT

The study was conducted to determine the economic profitability of the kharif maize in Karnal and Yamunanagar districts of Haryana. This study was conducted among 60 kharif maize as well as paddy farmers, 30 from Karnal and 30 from Yamunanagar district. The overall B:C ratio over total cost in kharif maize and paddy (Basmati) crops was 1.07 and 1.15, respectively. No doubt profit margin of paddy (Basmati) is higher than the kharif maize but the water saving potential is very high and cost of irrigation in kharif maize is very less as compared to paddy (Basmati). Overall irrigation cost for paddy (basmati) is near about four times higher than that of kharif maize.

Key words: Maize, Growth, Economic profitability, Paddy, B:C ratio

Kharif maize (*Zea mays* L.) is an important cereal crop in the world after wheat and rice. The importance of kharif maize lies in its wide industrial uses besides serving as human food, animal feed and fodder. It is the most versatile crop with wider adaptability to varied agro-climatic regions and has highest genetic productivity potential among the food grain crops. Agricultural growth based on wheat-paddy rotation has stagnated, leading to stagnation in income from agriculture [1]. Environmental concerns have been escalating, particularly relating to high levels and imbalance use of fertilizers, decline in the water table. Paddy crop is highly water intensive crop, as it consumes 3,000 litres of water to produce one kg of rice [2] (Saran *et al*, 2013). Thus, the sustainability of agriculture in state is under threat. In order to revitalize Haryana agriculture through exploring alternatives to the rice-wheat system, various expert committees and other groups have recommended the diversification of agriculture towards high-value commodities and a broader mix of traditional commodities and agro-processed products that augment farm income, promote exports and conserve soil and water resources [3]. Kharif maize is one of the best alternate crops, as the profits in Maize-Potato-Wheat rotation comes after Paddy-Potato-Wheat rotation [4].

India as a whole accounts 9633 thousand hectare of corn acreage in 2019 and produces approximately 27.71million tonnes, making kharif maize the third most important food grain after wheat and rice. It contributes nearly 9 per cent to the national food basket and more than Rs. 400 billion to the agricultural GDP besides generating employment to 1000 million man-days in the farm and downstream agricultural and industrial sectors. About 28 per cent of the

kharif maize produced in India is consumed directly as food like popcorn, baby corn, flour and cornflakes [5]. Eleven per cent of kharif maize is consumed as animal feed, 48 per cent as poultry feed, 11 per cent as starch, 1 per cent as brewery and 1 per cent as seed. The predominant kharif maize growing states that contributes more than 80 per cent of the total kharif maize production are Andhra Pradesh (20.9%), Karnataka (16.5%), Rajasthan (9.9%), Maharashtra (9.1%), Bihar (8.9%), Uttar Pradesh (6.1%), Madhya Pradesh (5.7%), and Himachal Pradesh (4.4%). Apart from these states kharif maize is also grown in Jammu and Kashmir and North-Eastern states. Hence, the kharif maize has emerged as important crop in the non-traditional regions i.e., peninsular India as the state like Andhra Pradesh which ranks 11th in 2018-19 in area (0.26 million hectares) has recorded the highest production (1.56 metric tonnes) and productivity (6.99 tonnes per hectare) in the country although the productivity in some of the districts of Andhra Pradesh is more or equal to the USA [6].

Haryana unlike the rest of India had traditionally been a kharif maize growing state until rice became popular. The kharif maize production in Haryana in 2018-19 was 15.6 thousand tonnes, and the total area under the crop was 5.9 thousand hectares. In Haryana, the kharif maize is sown normally during the end of May to end of June and is harvested in the months of September-October. A number of efforts were made to bring about technological breakthrough in this crop [7]. In spite of this, the area under kharif maize depicted a continuous decline during the Post-green revolution period. The decline in maize-acreage was mainly caused by the advent of HYVs of its competing crop i.e., rice [8].

The agricultural policy reflects the potential of kharif maize crop as the future crop of Haryana, becoming the most suitable replacement for paddy. Giving a boost to kharif maize cultivation in the state, Haryana Government has decided to provide Rs. 2000 incentive per acre with kharif maize seeds to the state farmers. The present study is initiated to examine the cost of production of kharif maize vis-a-vis paddy basmati in

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the state. The Haryana state has targeted towards other crops to maintain ecological balance and to save the depleting water table as well as soil condition of the state.

MATERIALS AND METHODS

The present study was conducted in Haryana and in order to achieve the stipulated objective, multi-stage sampling technique was followed for the selection of the study. Two districts with highest concentration of area under kharif maize for the year 2019 was selected namely Karnal and Yamunanagar. From each district two blocks were selected after that one village from each selected block. 15 farmers were randomly selected from village from each of these four blocks. Hence, a total of 60 farmers were surveyed. Analytical techniques the cost of cultivation of kharif maize and paddy basmati was estimated with the help of standard cost concepts with the tabular analysis. In operation costs, the cost of hiring human labour, machine power etc. have been estimated at prevailing market rate in the study area. The B: C ratio was worked by dividing total returns with total expenses incurred. It is an indicator of economic evaluation of farm technologies.

Trends and growth rates in area, production and productivity

For studying the compound growth rates (C. G. R.) in area, production, and productivity of kharif maize and paddy basmati for the Haryana and India were calculated for triennium ending 2000-03 to 2015-18. The compound growth rates were computed using the exponential function of the form:

$$X_t = ab^t u_t$$

$$\text{Log } X_t = \text{Log } a + t \text{ Log } b + \text{Log } u_t$$

Where;

X_t	=	Area/production/productivity/of maize and paddy in year 't'
t	=	Time elements which take the value 1, 2, 3, 4,.....n
a	=	Intercept
b	=	Regression coefficient
u_t	=	Standard error term

Compound growth rates were worked out as follow:

$$\text{Compound growth rate (r)} = (b-1) \times 100$$

A comprehensive schedule was prepared for the collection of information from the respondents keeping in view the objective of the study.

RESULTS AND DISCUSSION

The triennium ending average trend was increasing at national level in area, production and productivity of maize. The maximum area and production under kharif maize was observed in 2015-18 triennium i.e., 7485.09 thousand hectares and 18363.56 thousand tonnes and minimum were observed in 2000-03 i.e., 5965.43 thousand hectares and 10246.77 thousand tonnes, respectively. In triennium 2000-03, the productivity was 1718.12 kg/ha, whereas in 2015-18 it increased to 2451.62 kg/ha, respectively. It was due to the advent of hybrids of maize. The compound triennium growth rate of area, production and productivity under kharif maize crop was estimated to be 4.31, 12.11 and 7.46 per cent during triennium ending 2000 - 03 to 2015 - 18, respectively. The linear growth rate of area, production and productivity was estimated to be 0.04, 0.11 and 0.07 per cent, respectively [9].

In Haryana, the overall trend was decreasing in area, production and productivity. The maximum area under kharif maize was observed in 2000-03 triennium ending i.e., 16.33 thousand hectares and minimum area was observed in 2015-18 i.e., 5.67 thousand hectares. The results further revealed that the trend in production of kharif maize was also decreasing. Production was maximum in 2003-06 triennium ending i.e., 38.33 thousand tonnes and minimum in 2015-18 i.e., 17.67 thousand tonnes. In 2000-03, the productivity recorded per hectare was 2230.09 kg/ha, whereas in 2015-18 it increased to 3133.33 kg/ha. The compound growth rate of area, production and productivity under kharif maize crop was estimated to be -19.13, -14.58 and 5.80 per cent during 2000-2018, respectively. The linear growth rate of area, production and productivity was estimated to be -0.19, -0.15 and 0.06 per cent, respectively [10].

Table 1 Triennium ending average and growth rate of kharif maize in India as well as in Haryana

S. No.	Years	India			Haryana		
		Area	Production	Productivity	Area	Production	Productivity
1	2000-03	5965.43	10246.77	1718.12	16.33	36.67	2230.09
2	2003-06	6647.40	12122.23	1823.83	16.33	38.33	2345.59
3	2006-09	6991.27	13594.50	1943.48	13.10	31.13	2362.62
4	2009-12	7242.20	15139.00	2086.23	10.33	23.33	2272.22
5	2012-15	7362.50	16787.67	2280.37	8.67	22.67	2601.85
6	2015-18	7485.09	18363.56	2451.62	5.67	17.67	3133.33
	CAGR (%)	4.31	12.11	7.46	-19.13	-14.58	5.80
	LGR (%)	0.04	0.11	0.07	-0.19	-0.15	0.06

Area ('000' ha.), Production ('000' tonnes) and Productivity (Kg/ha.)

Cost of cultivation of kharif maize and paddy (Basmati) crops

All the input costs realized in kharif maize and paddy (Basmati) cultivation in Karnal, Yamunanagar district and overall have been represented in the (Table 2). Overall variable cost was accounted Rs. 36059 and Rs. 53732 in kharif maize and paddy (Basmati), respectively. It was found that the field preparation cost was the highest in both the crops i.e., Rs. 9038 and Rs. 14763 per hectare of kharif maize and paddy (Basmati), respectively [11]. The cost incurred for field preparation was higher in paddy (Basmati) as compared to

maize. Plant protection charge was the second highest cost in paddy (Basmati) Rs. 10549 (8.66%) but in case of kharif maize crop it was Rs. 5203 (5.95%) followed by harvesting and threshing charges in paddy (Basmati) accounted Rs. 10168 and in kharif maize it was Rs. 9120. As we compare irrigation cost in kharif maize and paddy (Basmati) it was just Rs. 2188 in kharif maize crop and Rs. 8400 in paddy (Basmati), which was approximately four times higher in paddy (Basmati). For the purpose of water saving kharif maize crop is best to replace the paddy (Basmati) crop [12]. It has

been observed from the table that all the variable cost components were higher in paddy (Basmati) except seed cost. In comparison of fixed cost, Rs. 51431 and Rs. 68033 were accounted in kharif maize and paddy crop, respectively. Rental value of land was the major fixed cost component it was Rs. 43125 and Rs. 55767 in kharif maize and paddy crop

followed by management and risk charges it was Rs. 7212 in kharif maize and Rs. 10746 in paddy crop [13]. The total cost incurred for the cultivation of kharif maize and paddy crops were Rs. 87490 and Rs. 121765, respectively. The total cost incurred in case of paddy (Basmati) is about one and half times more as compared to kharif maize cultivation [14].

Table 2 Cost of cultivation of kharif maize and paddy (basmati) crops (Per hectare)

Items	Karnal		Y/Nagar		Overall	
	Maize	Paddy (Basmati)	Maize	Paddy (Basmati)	Maize	Paddy (Basmati)
Field Preparation	9275 (10.43)	14688 (12.04)	8800 (10.23)	14838 (12.21)	9038 (10.33)	14763 (12.12)
Seed cost	4450 (5.00)	2256 (1.85)	4023 (4.68)	2015 (1.66)	4237 (4.84)	2136 (1.7)
fertilizer investment	4715 (5.30)	5367 (4.40)	4728 (5.50)	5438 (4.47)	4722 (5.40)	5402 (4.44)
Irrigation	2250 (2.53)	8600 (7.05)	2125 (2.47)	8200 (6.75)	2188 (2.50)	8400 (6.90)
Plant Protection	5220 (5.87)	10580 (8.67)	5185 (6.03)	10518 (8.65)	5203 (5.95)	10549 (8.66)
Harvesting/threshing	9250 (10.40)	10129 (8.30)	8990 (10.45)	10208 (8.40)	9120 (10.42)	10168 (8.35)
Total (1 to 6)	35160 (39.52)	51621 (42.31)	33851 (39.36)	51215 (42.15)	34507 (39.44)	51418 (42.23)
Interest on working capital	1582 (1.78)	2323 (1.90)	1523 (1.77)	2305 (1.90)	1553 (1.77)	2314 (1.90)
Variable cost (A)	36742 (41.30)	53944 (44.21)	35374 (41.13)	53520 (44.04)	36059 (41.22)	53732 (44.13)
Management and risk factor	7348 (8.26)	10789 (8.84)	7075 (8.23)	10704 (8.81)	7212 (8.24)	10746 (8.83)
Transportation cost	1125 (1.26)	1473 (1.21)	1063 (1.24)	1567 (1.29)	1094 (1.25)	1520 (1.25)
Rental value of land	43750 (49.18)	55804 (45.74)	42500 (49.41)	55730 (45.86)	43125 (49.29)	55767 (45.80)
Fixed cost (B)	52223 (58.70)	68066 (55.79)	50638 (58.87)	68001 (55.96)	51431 (58.78)	68033 (55.87)
Total cost (A+B)	88966 (100.00)	122010 (100.00)	86012 (100.00)	121521 (100.00)	87490 (100.00)	121765 (100.00)

Returns from the cultivation of kharif maize and paddy (basmati)

Returns from the cultivation of kharif maize and paddy (Basmati) in Karnal, Yamunanagar and overall are presented in (Table 3). Overall average production of kharif maize and paddy (Basmati) crops came out to be 54.09 and 51.90 q/ha and in Karnal and Yamunanagar districts it was 55.87, 51.80 and 52.30 and 52.00 q/ha, respectively [15]. The production of kharif maize was higher as compared to paddy (Basmati) in both the districts and overall. The overall gross returns were higher in paddy (Basmati) i.e., Rs. 140610 and Rs. 93861 in kharif maize crops. The gross returns in Karnal and

Yamunanagar districts in kharif maize and paddy crops were Rs. 96987 and Rs. 143420 and Rs. 90734 and Rs. 137800, respectively and the net returns were Rs. 8021 and Rs. 21410 and Rs. 4362 and Rs. 16279 in kharif maize and paddy crops in Karnal and Yamunanagar districts, respectively [16]. The gross and net returns were higher in paddy (Basmati) as compared to kharif maize crop because of high price per quintal in paddy (Basmati). The overall B: C ratio over total cost in kharif maize and paddy (Basmati) crops was 1.07 and 1.15, respectively. In Karnal and Yamunanagar districts the B: C ratio over total cost in kharif maize and paddy crops were 1.09, 1.18, 1.05 and 1.13, respectively [17].

Table 3 Returns structure of kharif maize and paddy (Basmati) crops (Per hectare)

Items	Karnal		Yamunanagar		Overall	
	Maize	Paddy (Basmati)	Maize	Paddy (Basmati)	Maize	Paddy (Basmati)
Productivity (qtl.)	55.87	51.80	52.30	52.00	54.09	51.9
Production (qtl.)						
Main product	93862	138286	87864	132593	90863	135440
By product	3125	5134	2870	5207	2998	5171
Gross returns	96987	143420	90734	137800	93861	140610
Return over variable cost	60245	89476	55360	84280	57802	86878
Net returns	8021	21410	4362	16279	6192	18845
B:C (over variable cost)	2.64	2.66	2.55	2.57	2.59	2.62
B:C (TC)	1.09	1.18	1.05	1.13	1.07	1.15

CONCLUSIONS

In India, the compound annual growth rate of area, production and productivity under kharif maize crop was estimated to be 4.31, 12.11 and 7.46 per cent during triennium ending 2000-03 to 2015-18, respectively. The linear growth rate of area, production and productivity was estimated to be 0.04, 0.11 and 0.07 per cent, respectively. Similarly, in Haryana, the compound annual growth rate of area, production and productivity under kharif maize crop was estimated to be -19.13, -14.58 and 5.80 per cent during triennium ending 2000-03 to 2015-18, respectively. The linear growth rate of area, production and productivity was estimated to be -0.19, -0.15 and 0.06 per cent, respectively. Overall variable cost per hectare was accounted Rs. 36059 and Rs. 53732 in kharif

maize and paddy (Basmati), respectively. It has been observed from the table that all the variable cost components were higher in paddy (Basmati) except seed cost. In comparison of fixed cost, Rs. 51431 and Rs. 68033 were accounted in kharif maize and paddy crop, respectively. The total cost incurred for the cultivation of kharif maize and paddy crops were Rs. 87490 and Rs. 121765, respectively. The total cost incurred in case of paddy (Basmati) is about one and half times more as compared to kharif maize total cost of cultivation. The production of kharif maize was higher as compared to paddy (Basmati) in both the districts and overall. The overall gross returns were higher in paddy (Basmati) i.e., Rs. 140610 and Rs. 93861 in kharif maize crops. The overall B: C ratio over variable cost and total cost in kharif maize and paddy (Basmati) crops was 2.59, 2.62 and 1.07, 1.15, respectively.

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