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Production Efficiency and Marketing Constraints of Basmati Rice in Punjab: An Economic Analysis

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Abstract

The present study has been carried out to analyze the production and marketing of basmati rice in Punjab using the cross-section data collected under centrally sponsored "Comprehensive scheme to study the cost of cultivation of principal crops in Punjab" during the agricultural year 2018-19. In Punjab the area, production, and productivity of basmati increased significantly with a compound annual growth rate of 10.62, 14.52, and 3.53 per cent, respectively during the period 2001-02 to 2020-21. Paddy and wheat were the dominant crops grown by the selected farmers with a share of 35.51 per cent and 43.60 per cent, respectively in the gross cropped area. The per hectare total variable cost of basmati cultivation in Punjab was Rs. 55021during 2018-19. Per hectare gross returns from basmati cultivation were Rs. 128262 and the returns over variable cost were Rs. 73240 in the Punjab state. The operations of transplanting, irrigation and harvesting & threshing were the major labour-intensive operations in cultivation of basmati rice. The per hectare usage of tractor in basmati cultivation has been found as 12.72 hours comprising 85 per cent owned and 15 per cent hired tractor use. Average hiring charges of tractor were found to be about Rs. 892 per hour. The major constraints faced by the farmers in production and marketing were lack of latest technical knowledge, high labour cost, unavailability of good quality FYM in time, lack of finance and credit facilities, the occurrence of rice diseases, not getting remunerative price for the produce, un-organized marketing & unstable price, lack of market information and high commission charges. Suitable policy measures need to be developed to overcome these constraints.

Keywords: Punjab, Basmati, Costs and returns, Marketing, Human labour, Problems

JEL Classification: O4, O13, Q1, Q17

Introduction

The most popular form of specialty rice cultivated on the Indian subcontinent is basmati rice. Its production and development are of significant importance to the area. It is a popular international product that is known for its distinct and pleasant aroma, fluffy contexture, taste, and ease of digestion, as well as linear kernel enlargement and little swelling width-wise (Rani *et al,* 2006). Basmati rice has superior export stipulate and fetches good export prices in international markets due to such individuality. The higher price of basmati rice in the international market made basmati rice as export aggressive produce. Among the food grains exported from India, basmati rice is a significant export item. Basmati rice exports have gradually increased over the last several years, from 7.7 lakh tonnes in 2003 to 40.4 lakh tonnes in 2017-18, due to higher demand from traditional markets in west Asia, Europe, and the United States. There are almost 132 basmati rice importing countries among which, Iran, Saudi Arabia, United Arab Emirates, and Iraq shared a large proportion of total basmati rice exported (APEDA, 2018).

Basmati rice has been farmed in the states of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, and Western Uttar Pradesh for generations (Singh and Singh, 2009). About 70 per cent of the world's basmati is produced in India, with the rest coming from Pakistan, Philippines, and China (Sidhu *et al,* 2014). In

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Punjab, basmati is grown mainly in the Amritsar, Tarn Taran, Gurdaspur, Kapurthala, Hoshiarpur, and Patiala districts of the state. Basmati had a total area of 3.4 lakh ha with a production of 9.24 lakh tonnes in 2008-2009, compared to 7.63 lakh ha with a production of 21.4 lakh tonnes in 2015-16. But in the 2016-17 kharif season Amritsar, Tarn Taran, and Gurdaspur districts witnessed 40 percent lower cultivation of basmati as compared to last Kharif season (Sharma *et al,* 2017). In India, the acreage under basmati in the states of Punjab, Haryana, and Uttar Pradesh shared about 95 percent of the total basmati area in India. The export scenario for Indian basmati rice showed positive signs in terms of both quantity and value realization. During the last decade, India's export of basmati to various destinations around the world increased at a rate of 9.69 and 12.46 percent in terms of quantity and value, respectively (Malik, 2019). The best varieties ever released for cultivation in Punjab are Basmati 370, PB 3, PB 1121, and PB 1509. Basmati 370, basmati 386, Taraori Basmati, Dehraduni, Ranbir basmati, and kernel (Pakistani) are the traditional varieties, and PB 1121, PB1509 are the evolved varieties of basmati. The traditional varieties are disappearing due to the introduction of new high-productivity varieties of basmati. The major reason for the disappearance of many local rice varieties was their steady replacement with the high-yielding varieties introduced in the 1960s with the green revolution. Native cultivars are robust, pest-resistant, use fewer farm inputs, provide good fodder, and have high nutritional and medicinal value grains (Amudha *et al,* 2011).

Data Sources and Methodology

In order to achieve the stipulated objectives, the present study has been conducted in the Punjab state. The cross section data, related to various inputs and outputs for basmati cultivation in Punjab for the year 2018-19 has been taken from the data collected under centrally sponsored "Comprehensive scheme for studying the cost of cultivation of principal crops in Punjab", operating in the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana. Under this scheme data were collected from 300 farmers spread in three agro-climatic zones of Punjab. The farmers growing basmati selected under the cost of cultivation scheme during the year 2018-19 were taken for the present study. There were 82 selected farmers (56 in zone-I, 15 in zone-II and 11 in zone-III) who cultivated basmati during the year under study. To identify the problems faced by the selected basmati growers in production and marketing of basmati rice, 30 selected farmers (10 from each zone) were revisited.

Tabular analysis

To examine the cost and return structure of basmati cultivation, simple averages and percentages were worked out for various cost and return items. The different cost items included to calculate variable costs are detailed below with their imputation procedure. These include value of seedling, manures and fertilizers, plant protection, hiring charges of implements, irrigation, human labour, machine and marketing charges.

Growth analysis

The compound growth rates (CAGR) for area, production and productivity of basmati were estimated for 2001-02 to 2020-21. The compound growth rates were estimated by using following exponential growth function.

$$Y_t = AB^t$$

Where,

Y_t = Area, production, productivity of basmati for year 't'

t = Time variable (1, 2….n)

A = Constant

B =Regression coefficient

Log transformation of the above function is as follows:

$$\ln Y_t = \ln A + t (\ln B)$$

$$r = [\text{antilog} (\ln B) - 1]$$

$$\text{CAGR} (\%) = [\text{antilog} (\ln B) - 1] \times 100$$

Results and Discussion

Area, Production and Productivity of Basmati

The trends in area, production and productivity of basmati in Punjab are presented in the table 1. Information given in the table revealed that, there was a considerable change in area, production and productivity of basmati in Punjab from 2001-02 to 2020-21. The area under basmati has increased from 102 thousand hectare in 2001-02 to 558 thousand hectare in 2011-12. Though there was a slight decline in 2016-17 to 502 thousand hectares. But it again started increasing and during the year 2019-20 it reached to 629 thousand

hectares. Which indicated 25.12 per cent increase in 2020-21 over 2001-02 with a compound annual growth rate of 10.62 per cent significant at one per cent level significance.

The production of basmati has increased from 245 thousand tonnes during 2001-02 to 2509 thousand tonnes in 2017-18. It further increased to 2718 thousand tonnes in 2019-20, with a compound annual growth rate of 14.52 percent, the rise in 2020-21 over 2001-02 is significant at the one per cent level of significance. Productivity of basmati increased significantly during the study period. It increased from 2402 kg in 2001-02 to 4369 kg in 2020-21. The productivity attained the highest level of 4595 kg in 2017-18. Which has a compound annual growth rate of 3.53 per cent, the rise in 2020-21 over 2001-02 is significant at the one per cent level of significance, shows 55 per cent increase in 2020-21 over 2001-02.

Land holding Pattern

The land holding pattern of the selected basmati growers is presented in table 2. It can be seen from the table that the size of operational holding of the selected farmers was 4.44 ha. The zone-wise, operational holding size was the largest in zone-III (5.09 ha), followed by zone-II (4.42 ha) and zone-I where it was 4.32 ha. In all the three zones major part of the operational holding was constituted by owned land. The average size of owned land was 3.60 ha in zone-I, while the corresponding figures for zone-II and zone-III were 3.52 and 4.85 ha, respectively

Cropping Pattern followed by basmati growers in Punjab

The cropping pattern followed on the farms of selected basmati growers has been depicted in table 3. It was found that most of the selected farmers followed paddy-wheat crop rotation with a share of 35.51 per cent and 43.60 per cent, respectively in the gross cropped area. The area under basmati crop was 0.82 hectares contributing 9.21 per cent to the gross copped area. It can also be seen from the table that around 3 per cent area both in rabi as well as kharif season was allocated to fodder crops by the sampled farmers.

Table 1. Area, Production and Productivity of basmati in Punjab

Year	Area (000' ha)	Production (000' tonnes)	Yield (Kg/ha)
2001-02	102	245	2402
2006-07	122	369	3029
2011-12	558	2022	3624
2016-17	502	2091	4165
2017-18	546	2509	4595
2018-19	511	2207	4319
2019-20	629	2718	4321
2020-21	406	1775	4369
CAGR (%)	10.62***	14.52***	3.53***

*Note: CAGR in per cent per annum *** denotes significant at one per cent level.*
Source: Department of Agriculture and Farmer's Welfare, Punjab.

Table 2. Pattern of land holding of basmati growers in Punjab, 2018-19

Tenure	Area (ha)			
	Zone I	Zone II	Zone III	Overall
Owned	3.60	3.52	4.85	3.75
Leased-in	0.74	0.90	0.44	0.73
Leased-out	0.02	0.00	0.20	0.04
Operational holding	4.32	4.42	5.09	4.44

Operation-wise human labour use for basmati cultivation in Punjab

A persual of table 4 shows operation-wise human labour used for basmati cultivation in Punjab. For cultivating one ha basmati rice, the farmers used 153 hours of family labour, 34 hours of attached labour and 245 hours of casual labour. The intensive family labour operations were irrigation which accounted for about 45 per cent of total family labour used, followed by others operations (guarding and supervision, transportation on farm etc.) 17 per cent, preparatory tillage (10 %), harvesting and threshing (seven per cent) and plant protection with seven per cent of the total family labour use.

The use of attached labour was found to be the highest for irrigation 18 hours per ha that accounted for about 52 per cent of total attached labour use. It was followed by preparatory tillage (3.14 hours per hectare) and manuring (three hours per ha). The plant protection and harvesting & threshing operation accounted for eight per cent each of total attached labour used. The attached labour used for interculture/ weeding was 2.46 hours per hectare followed by transplanting (1.13 hours) and others operations 1.11 hours per hectare. In the case of casual labour use for basmati cultivation, transplanting came out to be the major operation for which casual labour was hired. Its share in total casual labour use was around 53 per cent. Besides this around 32 per cent of total casual labour employed for one hectare basmati, was for harvesting and threshing. Other operation for which casual labour was hired includes manuring (3.08 %) and interculture/weeding with a share of 2.49 per cent.

It can also be seen from the table that out of total human labour (432.43 hour) used for one hectare of basmati cultivation; transplanting, irrigation and harvesting and threshing were the major operations that used 32.11 per cent, 20.07 per cent and 21.16 per cent share, respectively.

Machine power used for basmati cultivation in Punjab

Intensive cultivation in Punjab has been realized through the mechanization of the farms. The timeliness and effectiveness of various agricultural operations require appropriate and efficient use of farm machinery. The use of tractors, harvester combine, motorcycle/ scooter, power sprayer, and irrigation machines in the cultivation of basmati has been presented in table 5. The tractor is the most important machine, which along with implements is used for various operations like preparatory tillage, transportation of inputs on-farm,

Table 3. Cropping Pattern of basmati growers in Punjab, 2018-19

Particulars	Area (ha)	Share in Gross Cropped Area (%)
Kharif		
Paddy	3.16	35.51
Basmati	0.82	9.21
Cotton – BT	0.06	0.67
Fodder	0.27	3.03
Others	0.13	0.13
Rabi		
Wheat	3.88	43.60
Rapeseed & Mustard	0.03	0.34
Fodder	0.22	2.47
Others	0.23	2.58
Summer		
Maize	0.10	1.12
Gross cropped area	8.90	10.00
Net sown area	4.44	
Cropping intensity (%)	200.45	

Table 4. Operation-wise human labour use for basmati cultivation in Punjab, 2018-19

Operation	Family labour	Attached Labour	Casual labour	Total human labour (Hrs/ha)
Preparatory tillage	15.22 (9.94)	3.14 (9.11)	2.13 (0.87)	20.49 (4.74)
Transplanting	7.15 (4.67)	1.13 (3.28)	130.59 (53.32)	138.87 (32.11)
Manuring	6.69 (4.37)	3.08 (8.93)	7.55 (3.08)	17.32 (4.01)
Irrigation	68.81 (44.96)	18.00 (52.20)	0.00 (0.00)	86.81 (20.07)
Interculture/Weeding	9.64 (6.30)	2.46 (7.13)	6.11 (2.49)	18.21 (4.21)
Plant protection	9.69 (6.33)	2.78 (8.06)	4.15 (1.69)	16.62 (3.84)
Harvesting &Threshing	10.39 (6.79)	2.78 (8.06)	78.34 (31.99)	91.51 (21.16)
Others operations*	25.46 (16.64)	1.11 (3.22)	16.03 (6.55)	42.60 (9.85)
Total	153.05 (100.00)	34.48 (100.00)	244.90 (100.00)	432.43 (100.00)

**Guarding & supervision, transportation on farm, etc.*

Table 5. Machine power used for basmati cultivation in Punjab, 2018-19

Particulars	Owned Machine	Hired Machine		Total
	Hrs/ha	Hrs/ha	Rs/hr	Hrs/ha
Tractor	10.81 (84.98)	1.91 (15.02)	891.84	12.72 (100.00)
Harvester combine	0.06 (5.13)	1.11 (94.87)	1696.45	1.17 (100.00)
Power sprayer	1.43 (58.37)	1.02 (41.63)	70.66	2.45 (100.00)
Motorcycle/Scooter	1.92 (100.00)	0.00 (0.00)	0.00	1.92 (100.00)
Irrigation (Centrifugal/ Submersible Pump/ Oil engine)	173.32 (91.80)	15.48 (8.20)	80.23	188.80 (100.00)

Note: Figures in parentheses are percentages to total

threshing, cutting of straw, etc. The per hectare usage of tractors in basmati cultivation has been found as 13 hours comprising 85 per cent owned and 15 per cent hired tractor use. Average hiring charges of tractor were found to be about Rs. 892 per hour. About 1.17 hours of harvester combine were used for harvesting one hectare of basmati. Because of high cost and limited use mostly farmers do not prefer to purchase harvester combine and hire it for harvesting operation. The per hour hiring, charges for it were estimated at Rs. 1696 in the study area. Use of power sprayer for spraying, various herbicides, pesticides, micronutrients, etc. came out to be 2.45 hours per hectare. Out of total around 58 per cent use was of owned and 42 per cent use was of hired power sprayer. Many farmers use their motorcycle/scooter for supervision and transportation

Table 6. Costs and returns from basmati cultivation in Punjab, 2018-19

Item	Quantity	Value (Rs)
Gross Return		
Main Product (qtls)	40.52	124436.05
By Product (qtls)	28.61	3825.98
Total		128262.03
Variable Costs		
1. Seedlings	-	2101.82
2. Manures and Fertilizers		
i) Bio fertilizer	-	710.22
ii) Farm yard manure	-	3859.84
iii) Growth Regulator	-	1135.16
iv) NPK fertilizer	-	2112.41
v) Other fertilizer	-	998.93
vi) Other organic fertilizer	-	990.78
vii) Water Soluble Fertilizers and Micronutrients	-	1416.49
Sub-total		11223.83
3. Plant Protection		3994.17
4. Hiring charges of implements	-	300.97
5. Irrigation		
I. Owned machine (Centrifugal/submersible pump/ oil engines hrs)	173.32	1264.76
II. Hired machine (Centrifugal/submersible pump/ oil engines hrs)	15.48	1241.89
Sub-total		2506.65
6. Human Labour (Hrs)	432.55	21233.87
7. Machine(Hrs)		
I. Tractor	12.72	11344.46
II. Harvester combine	1.17	1982.51
III. Power sprayer	2.45	173.12
IV. Motorcycle/scooter	1.92	160.72
Sub-total		13660.35
Total variable costs		55021.66
Returns over variable cost		73240.37

of inputs. Its use was found to be 1.92 hours per hectare. Various irrigation machines like centrifugal pump, submersible pump, and oil engines were used to irrigate basmati fields. Their total use came out to be 189 hours per hectare with 92 per cent share of owned and 8 per cent share of hired machines.

Costs and returns from basmati cultivation in Punjab

The data given in Table 6 shows that per ha total variables cost of basmati cultivation in Punjab was Rs. 55022 during 2018-19. The examination of major components of variable cost revealed that expenditure

Table 7. Problems faced by basmati growers in production of basmati in Punjab, 2018-19

Production Problems	Number of respondents
High labour cost	26 (86.67)
Un-availability of labour during peak period	23 (76.67)
Un-availability of good quality fertilizer/ FYM in time	18 (60.00)
Occurrence of rice diseases	21 (70.00)
High cost of pesticide	26 (86.67)
Lack of good quality seedling in sufficient quantity	15 (50.00)
Lack of latest technical knowledge	14 (46.67)
Lack of finance and credit facilities	9 (30.00)
Total number of farmers	30

Note: Figures in parentheses are the percentages of the total number of respondents of the respective samples.

on human labour in basmati cultivation was Rs. 21234 per ha. The second major component in the cultivation of basmati was machine labour and expenditure on it was Rs. 13660, followed by manures and fertilizers with the expenditure of Rs. 11224 per hectare. Other main components in the cultivation of basmati rice were plant protection, irrigation, seedling, marketing charges, and hiring charges of implements. The expenditure on these components was Rs. 3994, Rs. 2507, Rs. 2102, Rs. 1441, and Rs. 301 per ha, respectively. The per ha gross returns from basmati cultivation were Rs. 1.28 lakh and the returns over variable cost came out to be Rs. 73240 in the Punjab state.

Production constraints

A number of problems faced, by respondents in the production of basmati. These problems are listed in table 7. It can be seen from the table that out of various

Table 8. Problems faced by basmati growers in marketing of basmati in Punjab, 2018-19

Marketing Problems	Number of respondents
Not getting remunerative price the produce	24 (80.00)
Cheating by middlemen	10 (33.33)
High cost of transportation	16 (53.33)
High commission charges	13 (39.39)
Lack of marketing information	16 (53.53)
Un-organized marketing and unstable price	25 (83.33)

Note: Figures in parentheses are the percentages of the total number of respondents of the respective samples.

problems faced by basmati growers in production, the problems of high labour cost and high pesticide cost were reported by around 87 per cent respondents. These were followed by unavailability of labour during peak period, occurrence of diseases and unavailability of good quality fertilizers in time, which were reported by more than 70 per cent respondents.

Marketing constraints

The marketing problems faced by basmati growers in the study area have been presented in the table 8. It can be seen from the table that unorganized marketing and lack of remunerative price were the major marketing problems reported by more than 80 per cent respondents. Besides this high transportation cost, cheating by middlemen, high commission charges and lack of marketing information were other problems report by many farmers.

Conclusion and Policy Implications

Basmati rice is India's greatest strength, as its quality in terms of grain length and aroma is unmatched by any other rice variety in the world. There has been a commendable increase in the production of basmati in the country due to the area expansion and yield enhancement. India is the world's biggest supplier of basmati rice, leading to consistent increases in production and rising demand on the global market. This has benefited all stakeholders including farmers. However, a huge potential still remains to be realized. Punjab is one of the major producers of basmati rice in India. The production can be further improved through effective policy initiatives. There is need to increase basmati yields through research on improved varieties and transferring them to farms. In addition to developing technologies to increase basmati yields, farmers should be prioritized in receiving necessary inputs on time and at a reasonable price. Infrastructure for storage, finance, and marketing needs to be developed further. There is need to streamline the administrative procedures for the export of basmati rice.

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