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Impact of contract farming on basmati rice (*Oryza sativa*) in India

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ABSTRACT

India is world's second largest producer of rice and largest exporter of basmati rice in the world. Total paddy production in the year 2018-19, was 115.6 million tonnes and basmati rice output was 5.31 million tonnes. Basmati rice export is projected to hit a record level of ₹ 30000 crore or nearly $4.28 billion this season. The largest exported basmati variety is Pusa 1121 and the procurement price was ₹ 35000-38000 a tonne in the year of 2018-19 which was 8.5% higher than the price in 2017-18. A study was undertaken to analyse the contract farming dealing with Pusa Basmati 1121 and its economic impact on farmers in Ghaziabad district of Uttar Pradesh during 2017-18. The findings of the study reveal that the impact of contract farming on yield of basmati rice was found to be positive. The total income was more for contract farmers than non-contract farmers. Total input costs were slightly higher on contract farm than non-contract farm. Major factors responsible for farmers' participation in the contract farming were found to be company guidance for scientific method of cultivation, higher price for produce received from contracting firm, assured purchase by contracting firm and age of the farmer. It is suggested that agricultural marketing and agri-business system needs institutions and innovations, to create and develop different marketing strategy for further increase in agricultural production.

Key words: Basmati rice, Contract farming, Cost and returns analysis, Constraints, Garrett's ranking technique, Logistic regression model

The present era of globalization and liberalization has witnessed significant changes in agriculture, which are the backbone of Indian economy. These changes include cropping technology as well as cropping patterns along with development of several new institutions. Export-oriented products and processed food items occupy a vital position in the agricultural market these days. Contract farming is an option to promote production of such high-value crops. Basmati rice is being cultivated under contract which fulfills the desired demand of both farmers and Basmati exporting companies. In India most of the farmers belong to small and marginal categories, and are found to be resource-poor. At the same time the agro-processing firms are lacking in possession of land for cultivation of high-value crops. That is why these companies come forward with contracts in providing such costly inputs, improved crop varieties, and advanced technology to the resource-poor farmers. Hence, contract farming has attained a greater place in today's agriculture and it continues to play a major role in commercialization.

A study was undertaken on contract farming of Basmati rice Pusa 1121 in Ghaziabad district of Uttar Pradesh. The contracting is covering more than 70000 farmers in the region with coverage of nearly 250000 acres. It was observed that the contracting firm closely monitor contract farming operations that support in keeping consistent supply of good quality paddy seed. The company besides guiding the farmers for agricultural practices it engages proactively in various programs for the upliftment of the farming community. It was observed that contracting firm conducts awareness campaigns to promote better and cost-effective farming techniques, thereby helping the farmers and their families to improve their incomes and living standards. Skill development camps are also held to empower farmers to augment their capacities and capabilities. With this backdrop the present study was undertaken with the following objectives: (a) to study the contractual arrangements, institutional linkages, and participation of farmers in the contract farming of basmati rice; (b) to examine the impact of contract farming on income generation and factors responsible for farmers' participation in contract farming and (c) to identify the constraints faced by farmers in contract farming.

MATERIALS AND METHODS

The primary data was collected using a multilevel stratified sampling technique. The Ghaziabad district of Uttar Pradesh was purposively selected based on a higher proportion of area under contract farming. Further two

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blocks having a higher proportion of area under contract farming were selected purposively from selected district. Finally, 25 farmers were randomly selected from each block who were attached to the contract farming, further, for the purpose of comparison, 25 non-contract farmers were also selected randomly from the same block. Thus, a total of 100 farmers were interviewed consisting of 50 farmers involving contract farming and 50 farmers without contract farming. The primary data was collected from the sample farmers by personal interviews using well-structured and pre-tested questionnaire. These farmers were interviewed to collect information on cost of production, productivity, income, and the constraints faced in contract farming in the study area during the year 2017-18.

Logistic regression model

Determinants of participation in the contract farming were estimated using the binary logistic regression model. The logistic regression model postulates that P_i, the probability that i^{th} farmer adopting contract farming is a function of an index variable Z_i summarizing a set of explanatory variables. In fact, Z_i is equal to the logarithm of the odds ratio, i.e. ratio of probability that a farmer participates in contract farming to the probability that he does not participate in contract farming and it can be estimated as a linear function of explanatory variables (X_{ki}).

$$\frac{\Delta p_i}{\Delta X_i}\left\{all\ other\ X\ cons\tan t = \frac{\partial p_i}{\partial X_i}\right\} \quad (1)$$

where, i = 1, 2,..., N. and N is the total number of farmers, k= 1, 2,...., M. and M is the total number of explanatory variables and α = constant and β = an unknown parameter.

The factors which are hypothesized to influence the effective participation of farmers include age of head of the household, education (illiterate=0, else=1), company guidance, seed supply, chemicals arrangement etc.

The marginal effects are the effect of a unit change in X_i all other factors held constant, on the probability that a farmer choose to adopt contract cultivation. The marginal effect for the logit model is expressed as

$$\frac{\Delta p_i}{\Delta X_i}\left\{all\ other\ X\ cons\tan t = \frac{\partial p_i}{\partial X_i}\right\} \quad (2)$$

The Garrett's ranking technique was used to find out the most significant factor which influences the respondent (farmer) for the effectiveness of participation in contract farming. As per this method, respondents have been asked to assign the rank for all factors and the outcome of such ranking have been converted into score value with the help of the following formula:

$$\text{Percent position} = 100*(R_{ij}-0.5)/N_j$$

where, R_{ij} is the rank given for the i^{th} variable by j^{th} respondents, N_j is the number of variables ranked by j^{th} respondents. With the help of Garrett's table, the percent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then the total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor.

RESULTS AND DISCUSSION

Success in developing contracting models or other forms of farm-firm linkages that are effective for smallholders will be a key challenge to smallholder participation in the transformation of Indian agriculture. A contracting firm was studied which helps farmers to procure paddy from prime basmati growing regions of UP, Uttarakhand, Punjab, and Haryana. It helps to buy paddy after intensive quality checks of soil and paddy cultivation. It provides facility to test for aflatoxin, microbiological test, and residual tests. The economics of contract farming, i.e. the returns among different farm sizes were estimated and the probability of participation in contract farming due to various factors and the constraints faced by farmers in contract was examined.

Contractual arrangements of contract farming

Contracting agreements were found to be verbal and informal in nature, and there was no written contract agreement which will provide the legal protection to both farmers and contracting company in the study area. It was observed that company field staff goes to farm in their field areas and guides the farmers about various operations and purchasing options, who are participating in contract farming. They guide the farmers regularly for a scientific method of paddy cultivation. The paddy seed was provided by the contracting company. The company had a tie-up with agricultural chemical companies such as Bayer and Syngenta which helps the farmers to get non spurious chemicals at the market price. After the production is harvested, a sample is taken from produce and sent to contracting company laboratory for testing. Once the quality is assured then the produce is purchased by contracting firm with a premium price of ₹ 150 over the prevailing wholesale market price. It was observed that sample farmers under contract farming had nearly 22%, 26% and 52% marginal, small and medium/ large categories of farmers respectively. The average size of holding (ha) of contract farms was 0.66 ha, 1.48 ha and 5.62 ha for marginal, small and medium and large farmers respectively. Whereas, the average size of landholding was low for non-contract farming in the same region. It was observed that young farmers opt more for contract farming.

Economics of basmati rice cultivation

The costs and returns realized from basmati rice cultivation in contract farming and non-contract farming were analysed and the results are presented in Table 1. The farm income for contract farmers was higher than that of non-contract farmers. Chang *et al*. (2006); Kumar and Prakash Kumar (2008) found that the average gross farm income was higher on contract than that of non-contract farms. The average per ha gross return from Pusa 1121 cultivation was ₹ 144189 for contract farmer and average gross returns for non-contract farmers were ₹ 125538. The net returns were

Table 1 Costs and returns from basmati rice cultivation of contract farming and non-contract farming

Particulars	Contract farming				Non-contract farming			
	Marginal	Small	Medium/Large	All	Marginal	Small	Medium/Large	All
Gross return (₹/ha)	123194	150851	158523	144189	98763	134982	142869	125538
Total cost (₹//ha)	41984	45711	46112	44602	35553	38842	40458	38284
Net return over total cost (₹//ha)	81210	105140	112411	99587	63210	95140	102411	86920

also found to be more for contract farmers when compared with non-contract farmers in the same region.

Probability of participation in the contract farming

The success of contract farming depends on the number of farmers willing to join the contract farming. There are several determinants that affect participation in contract farming by the farmers of the sample area. The factors which were hypothesized to influence the probability of participation of farmers in contract farming were estimated using logistic regression analysis and the variables which are included are age, education, company guidance for farming, supply of seed, agreement with chemicals suppliers, payment of higher price compared to market, transparent system of purchase by contracting from farmer and assured purchase from farmers. The results of logistic regression model indicated that the variables like age, company guidance, higher price for produce and assured purchase by the company were found to be positive and significant factors in the choice of participation in contract farming (Table 2).

The analysis of the marginal effects shows that the probability of joining contract farming decreases by 13% for a one year increase in age. Similarly the contracting company guidance for scientific farming with modern technologies increases the probability of joining the contract farming by 23%. Further, the higher price received by the farmers for their produce from contracting farm helped in 26% higher probability to join contract farming. Finally, assured purchase from the farmer increased the probability of joining the contract farming by 20%. The factors like education, seed supply, chemical arrangements, transparent system of purchase by contracting company and quality fixation were not significant factors in influencing for joining the contract farming.

Constraints in contract farming

The contract farmers expressed a number of constraints which needs attention for the policy makers. Based on the information collected from the sample farmers, the major constraints faced in contract farming by farmers were ranked and prioritized using Garrett's ranking method. Lack of credit for crop production was the most important constraint which ranked first with Garrett score of 69.07 followed by labour scarcity (68.83), scarcity of water for irrigation (65.62), difficulty in meeting quality requirements (63.33) and), and distance from the company (62.96). Kumar and Prakash Kumar (2008) also confirmed that lack of credit for crop production, scarcity of water for irrigation and difficulty in meeting quality requirements were the major constraints faced by contract farmers.

There are various marketing models, and among these are contract farming including those led by an individual, or by farmer groups, or by cooperatives, and by various types of private processing sectors that develop backward and forward linkages with growers. Contract farming helps farmers to adopt improved technology and higher productivity and quality production which boost export and is a fair and equitable rewarding system for the farming community. It provides technology and certain quality inputs to the farmer and scientific advice for efficient farming. It helps in transparent system of marketing with premium price to the farmers. A study of contract farming in basmati rice was undertaken. It was observed that farmers under contract farming were getting many benefits hence more number of farmers were willing to join the contract farming. Aromatic Pusa Basmati 1121 is the paddy variety grown by contracting firm largely because of export demand which fetches high price in the international market. The farmers get a higher price of ₹/150/tonne by adopting contract farming over the prevailing wholesale market price. Often these contract farming produces crops that are of high value and are bought back by the company. Therefore often the company is the price maker and farmer is the price taker resulting in loss of farmers bargaining power. However company guidance

Table 2 Estimated coefficients of the logit model for participation in contract farming

Parameters	Coefficients	P-value (Wald)
Intercept	-1.6849	0.006
Age (years)	-0.2135*	0.0281
Education	0.1047	0.270
Company guidance	0.4928*	0.010
Seed supply	0.0184	0.41
Chemicals arrangements	0.3365	0.213
Transparent system of purchase by contracting company	0.6732	0.32
Higher price for produce	0.6505*	0.021
Quality fixation	0.8587	0.213
Assured purchase by company	0.3347*	0.038

* denote significant at 5% level

for scientific method of cultivation, higher price and assured market provision make contract farming attractive for the farmer. Many multinational companies have begun contract farming in India. These companies should encourage other producing and consuming enterprises to emulate such mutual benefits which will also support the food and nutrition security of the country.

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