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RESEARCH PAPER

Cost, returns and resource use efficiency in hybrid brinjal seed production under contract farming in Haveri district of Karnataka

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Abstract: The present study was conducted in Haveri district of Karnataka. A sample of 32 farmers practicing hybrid brinjal seed production was selected randomly. The data were collected for the agricultural year 2015-16 through personal interview method. Results revealed that total of 604.48 mandays were employed which include 176.38 mandays of male and 428.10 mandays of female labour. About 423.31 mandays of labour employed only for pollen collection and pollination. The per acre total cost was found to be ₹ 2,30,771. Among variable costs, expenditure on human labour was found highest (59.10%). Average output obtained was 455.63 kg seeds per acre. The average selling price of seeds was ₹ 983 per kg. per acre gross return, net return over variable cost and net return over total cost realised were ₹ 4,47,884, ₹ 2,29,909 and ₹ 2,17,113 respectively. Cost of production was ₹ 506.49 per kg seeds. Return per rupee of expenditure was ₹ 1.94. The output elasticities of human labour (1.71), seedlings (0.26) and irrigation (0.10) were significant. The coefficient of multiple determination (R^2) was 0.88. An increasing return to scale was observed (Hbi=2.26). The MVP to MFC ratio was found to be highest in seedlings (61.05), followed by irrigation (24.40), FYM (9.99), human labour (5.64) and mulching (2.18).

Key words: Cost, Hybrid seed, Input use, Returns

Introduction

Contract farming has been in existence for many years as a means of organizing the commercial agricultural production of most of the small and marginal farmers. In the era of globalization, the concept of 'Contract Farming' is an effective way to co-ordinate production and marketing in agriculture. Hence, contract farming under new approach allows a greater degree of control over the production process regarding quantity, quality and the timing of what is being produced. and also the product, without any investment of the company (Mulimani, 2015). Contract farming involves agricultural production being carried out on the basis of an agreement between the buyer and farm producers. The farmer undertakes to supply agreed quantities of a crop or livestock product, based on the quality standards and delivery requirements of the purchaser. In return, company agrees to buy the product often at a price that is established in advance. The company agrees to provide production advice to farmers.

For the first time, contract farming was started in Taiwan way back in 1895 by Japanese government. In India it was started in Rajasthan by the Pepsi Company in tomato and potato crops. In Karnataka it was first time started in gherkin crop in 20th century. In India more than 150 companies have involved in vegetable seed production. India is the second largest vegetable seed producing country first being China. Due to advances in technology and availability of quality seeds the total production and economic value of vegetables has doubled in India over a period of ten years from 2002 to 2012. India in 2013 produced 162 mt of vegetables from an area of 9.2 m ha with productivity of 17.6 metric tonnes per hectare. India's share in world's vegetables production is 14 per cent. India lags far behind in productivity in comparison to developed countries. Increased availability and adoption of improved varieties or hybrids have been recognized as a probable solution for enhancing the productivity levels of vegetables. In this view, there has been an increasing trend in the adoption of hybrid seed technology in vegetables during the past two decades. Although capital and labour-intensive of this technology, it has increased the profitability of farmers through improved productivity.

Seed production in vegetables, especially of hybrids though a specialized skilled activity was transformed into a commercial economic activity by the private seed companies way back to late 1970s and was largely undertaken on the farmers' fields. The commercial seed production in vegetables not only meets domestic demand but also earns a sizeable foreign exchange to the central exchequer, and thus adds substantially to improve the economic status of the farm families (Sudha *et al.,* 2006). Hence, the present study was undertaken to bring out the clear picture of socio-economic status of the hybrid brinjal seed producing farmers, to estimate the costs and returns involved in it, to analyze the resource use efficiency and to know the modus operandi prevailing between farmers and the seed company in the study area.

Material and methods

The study was conducted in two taluks of Haveri district namely Ranebennur and Hirekerur which were selected purposively. The data were collected for the agricultural year 2015-16 through personal interview method. Multistage stratified random sampling technique was adopted for the selection of the sample villages and farmers. From each selected taluk, two villages were selected randomly, from each village eight farmers were

selected randomly which makes a total sample size of 32 farmers. The study is based on primary data collected from randomly selected brinjal producing farmers with the help of pre-tested schedule through personal interview method.

To fulfil the specific objectives of the study, based on the nature and extent of availability of data, analytical tools and techniques *viz.,* tabular analysis was adopted to compile the general characteristics of the sample farmers, budgeting technique was used to estimate the costs and returns in hybrid brinjal seed production and Cobb-Douglas production function was used to study the resource use efficiency in hybrid brinjal seed production (Nagaraj, 2014).

Results and discussion

Socio-economic profile of hybrid brinjal seed producing farmers

Socio-economic profile of hybrid brinjal seed producing farmers in the study area is in Table 1. Most of the farmers were of medium aged (71.88%) followed by young aged (15.63%) and old aged farmers (12.50%) indicating that they had better experience, ability to do the work efficiently and also they were innovators in adopting new technologies into brinjal seed production. Most of the farmers were literates of which majority (68.75%) of them had primary education. As most of the farmers were educated they were able to find the source of required information and influenced the adoption and proper use of the technology. With respect to land holding, about 40.63 per cent of the farmers were medium farmers followed by small farmers (34.38%). This indicates that hybrid brinjal seed production is practiced mostly by small and medium farmers as it involves intensive farming. Some results are more or less in accordance with the findings of Nayak (2014) where about 31.67 per cent of the respondents had middle school education and majority (54.17%) of the respondents were small farmers.

Majority of the farmers (68.75%) were members in co-operatives followed by Self Help Group members (25%) since these institutions are easily accessible and more relevant to their occupation. With respect to source of income, on an average farmers earned per acre 92.42 per cent (₹ 4,67,411) of the total income from brinjal seed production. This indicates that hybrid brinjal seed production was more lucrative venture than other prevailing cash crops in the district. With respect to occupation, about 87.50 per cent of the farmers had agriculture as their main occupation. The same result was observed by Mulimani (2015) where majority of the farmers (33.33%) were of medium aged and 92.50 per cent of the respondents' main occupation was agriculture.

Labour use pattern in hybrid brinjal seed production

It can be seen from the Table 2 that in hybrid brinjal production total of 604.48 mandays were employed of which 176.38 mandays of male and 428.10 mandays of female labours were employed for carryout different activities. For pollen collection and pollination about 423.31 mandays, for FYM transportation and its application 10.67 mandays, for bed preparation and mulching 21.75 mandays and for application of fertilizers 20.92 mandays were employed. About 14.25 mandays for spraying of chemicals and 29.25 mandays for harvesting

Table 1. Socio-economic profile of hybrid brinjal seed producing farmers

Sl. No.	Particulars	Nos.	Per cent
I.	Age group		
	Young (<35 Years)	5	15.63
	Medium (35-50 Years)	23	71.88
	Old (>50 Years)	4	12.50
	Total	32	100.00
II.	Educational status		
	Illiterates	4	12.50
	Primary (1st to 7th std)	22	68.75
	Secondary (8th to10th std)	4	12.50
	College (1st and 2nd PUC)	2	6.25
	Total	32	100.00
III.	Category of farmers		
	Marginal (<2.5 acres)	3	9.38
	Small (2.5-5 acres)	11	34.38
	Medium (5-10 acres)	13	40.63
	Large (>10 acres)	5	15.63
	Total	32	100.00
IV.	Social participation		
	Co-operative	22	68.75
	Self help group	8	25.00
	Panchayat	1	3.13
	Others	1	3.13
	Total	32	100.00
V.	Sources of income		
	Seed production (¹ /acre)	4,67,411	92.42
	Cash crops (¹ /acre)	30,662	6.06
	Diary (¹)	7,625	1.52
	Total (¹)	5,05,698	100
VI.	Main occupation		
	Agriculture	28	87.5
	Dairy	4	12.5
	Total	32	100

Table 2. Labour use pattern in hybrid brinjal seed production per acre

Sl. No.	Type of operation	Male (mandays)	Female (converted mandays)	Total human labour
1.	Land preparation	4.75	0.00	4.75
2.	Transportation & application of FYM	8.00	2.67	10.67
3.	Bed preparation and mulching	21.75	0.00	21.75
4.	Planting	4.13	5.17	9.29
5.	Weeding	5.13	6.58	11.71
6.	Fertilizer application	14.50	6.42	20.92
7.	Pollen collection and pollination	44.13	379.19	423.31
8.	Irrigation	12.63	0.00	12.63
9.	Roughing	8.63	4.08	12.71
10.	Spraying of chemicals	14.25	0.00	14.25
11.	Harvesting	16.75	12.50	29.25
12.	Seed extraction	6.00	3.08	9.08
13.	Seed drying and cleaning	15.75	8.42	24.17
	Total	176.38	428.10	604.48

and total of 24.17 mandays were employed for seed drying and cleaning. It is clear from the results that more number of labour mandays was used for pollen collection and pollination followed by harvesting. This indicates that hybrid brinjal seed production is a specialized operation which involves greater care and patience hence requires more number of skilled labours. Some years back seed extraction process was a time consuming activity but now a days due to adoption of seed extraction machine this process has become easy.

Input use pattern in hybrid brinjal seed production

It is evident from the Table 3 that on an average farmer used 1536 male and 3859 female seedlings. The quantity of FYM applied was 5.97 tonnes per acre. About 190.07 kg of different chemical fertilizers were applied as per instructions given by contract company staff. Around 6.19 kg of micronutrients were used to overcome nutrients deficiency. On an average of 9.13 litres of PPC was used to control pests like hadda beetle and brinjal fruit and shoot borer. Around 1797 staking sticks were used for supporting the plant, 10.75 kg of threads and 94.63 kg of polythene mulch were used to control the weeds infestation. On an average 604.48 mandays of human labour, 4.50 pairdays of bullock labour and 20.06 hours of machine labour employed per acre by hybrid brinjal seed growers.

Cost structure in hybrid brinjal seed production

Table 4 showed per acre total cost involved in hybrid brinjal seed production. It was found that total cost was ₹ 2,30,771, out of which variable cost was ₹ 2,17,841 (94.40% of the total cost) and fixed cost was ₹ 12,930 (5.60% of the total cost). While results of Nandeshwar *et al.* (2014) showed that per acre total cost in commercial brinjal production was ₹ 33,050.

Among the variable cost, cost incurred on human labour was the major item, which accounted for ₹ 1,36,390 (59.10% of the total cost) followed by cost on machine labour ₹ 15,350 (6.65%). This is one of the important aspects of hybrid brinjal seed production which incurs maximum cost due to high wage rate. Since it is a specialized activity requires skilled labours. Hence, there is a need to improve efficiency of labours by providing further skill oriented trainings and facilities. Interest on working capital at seven per cent interest rate was ₹ 14,251 (6.18% of the total cost) and the cost on mulching was ₹ 14,163 (6.14% of the total cost). Since polythene mulching materials were used only for one seed production season which forms another important cost component. The cost on stakings and gunny threads was ₹ 12,041 (5.22% of the total cost), cost on PPC was ₹ 10,172 (4.41% of the total cost) and cost on fertilizers and micronutrients together incurred ₹ 6309 (2.73% of the total cost). Among fixed cost, rental value of land was the major cost, which accounted for ₹ 10,993 (4.76% of the total cost) and other item of fixed cost like depreciation cost was ₹ 656 (0.28%). Land revenue is included in the rental value of land. The interest on fixed capital at 11 per cent interest rate was ₹ 1281 (0.56%).

Table 3. Input use pattern in hybrid brinjal seed production per acre

Particulars	Unit	Quantity
Seedlings		
Male	no.	1,536
Female	no.	3,859
FYM	t	5.97
Chemical fertilizers	kg	190.07
Micronutrients	kg	6.19
Plant protection chemicals	lit	9.13
Stakings	no.	1797
Threads	kg	10.75
Polythene Mulch	kg	94.63
Labour		
Human labour	mandays	604.48
Bullock labour	pairdays	4.50
Machine labour	hr	20.06

Returns structure

It was evident from the Table 4 that average output (seeds) obtained was 455.63 kgs per acre. Selling price per kg of seeds was ₹ 983. Gross return realised was ₹ 4,47,884. Total cost incurred was ₹ 2,30,771. Net return over variable cost was ₹ 2,29,909 and net return over total cost was ₹ 2,17,113 per acre. Cost of production was ₹ 506.49 per kg seeds. It was found that return per rupee of expenditure was ₹ 1.94. This clearly indicates that hybrid brinjal seed production was found to be profitable and beneficial to the farmers in relation to the total cost incurred by them. While results of Nandeshwar *et al*. (2014) showed that per acre gross return in commercial brinjal production was ₹40,723.

Table 4. Cost and returns structure in hybrid brinjal seed production

I. **Cost structure (per acre)**

Sl. No.	Particulars	₹/acre	Per cent
A.	Variable cost		
1.	Seedlings	1,930	0.84
2.	FYM	3,092	1.34
3.	Chemical fertilizers	4,546	1.97
4.	Micronutrients	1,763	0.76
5.	Plant protection chemicals	10,172	4.41
6.	Stakings and gunny threads	12,041	5.22
7.	Polythene mulch	14,163	6.14
8.	Irrigation charges	1,894	0.82
9.	Labour		
a.	Human labour	1,36,390	59.10
b.	Bullock labour	2,250	0.97
c.	Machine labour	15,350	6.65
10.	Interest on working capital (@ 7%)	14,251	6.18
	Subtotal (I)	2,17,841	94.40
B.	Fixed cost		
Rental value including land revenue		10,993	4.76
Depreciation		656	0.28
Interest on fixed capital (@ 11%)		1,281	0.56
	Subtotal (II)	12,930	5.60
	Total cost (I+II)	2,30,771	100.00

II **Returns structure**

Sl. No.	Particulars	Unit	Amount(₹)
Output (seeds)		kg	455.63
Selling price of seeds		₹/kg	983
Gross return		₹	4,47,884
Net return over variable cost		₹	2,29,909
Net return over total cost		₹	2,17,113
Cost of production		₹/kg	506.49
Return per rupee of expenditure		₹	1.94

Resource use efficiency in hybrid brinjal seed production

The estimated coefficients of Cobb-Douglas production function are presented in Table 5. The output elasticity of human labour (1.72) was significant at one per cent, the output elasticities of seedlings (0.26) and irrigation (0.10) was found significant at five per cent. This showed that increase in the use of these inputs would result in increased efficiency of hybrid brinjal seed production. The output elasticities of mulching (0.06), FYM (0.06), bullock and machine charges (0.06), stakings and gunny threads (0.0093) and PPC (0.0017) were positive, but found to be non-significant hence it would not be profitable to further increase in the use of these inputs. Fertilizers and micro nutrients (-0.03) were non-significant with negative elasticities indicated that these inputs are over-utilized. This is due to the reason that FYM application has long-term effect on output; hence farmers used more doses of chemical fertilizers and micro nutrients to get quick results. Over utilization of fertilizers was also observed by Tegar *et al*. (2016).

The coefficient of multiple determination (R^2) was 0.88 which indicates that 88 per cent of the variation in the output of hybrid brinjal is explained by the explanatory variables included in the function. The sum of elasticities (∑bi) was 2.26 which indicated an increasing return to scale *i.e.*, simultaneous increase in all the inputs by one per cent would increase the output by 2.26 per cent.

Allocative efficiency (MVP: MFC) of hybrid brinjal seed production

Allocative efficiency of resources used in the production of hybrid brinjal seed has been presented in the Table 5. The ratio of MVP to MFC in case of seedlings, farm yard manure, human labour, bullock and machine charges, plant protection chemicals, irrigation, stakings and gunny threads and mulching were 61.05, 9.99, 5.64, 1.55, 0.07, 24.40, 0.34 and 2.18 respectively indicating returns of ₹ 61.05, 9.99, 5.64, 1.55, 0.07, 24.40, 0.34 and ₹ 2.18 for every additional unit of inputs used in that order. The negative MVP to MFC ratio for fertilizers and micronutrients (-2.66) indicates that these two inputs were over-utilized, resulting in a loss of ₹ 2.66 for every one rupee spent on these factors. Over utilization of fertilizers was also observed by Tegar *et al.* (2016).

Conclusion

The present study clearly depicts that hybrid seed production is practiced mostly by small and medium farmers in the study area. Hybrid seed production in brinjal is a labour intensive activity requires skilled labours especially for pollen collection and pollination and is also an input intensive requires more quantity of physical inputs like chemical fertilizers, pesticides etc. Hybrid seed production activity is highly profitable and capital intensive requires huge investment compared to commercial production on area basis. Inputs like fertilizers and micro nutrients are over utilized in brinjal seed production.

Table 5. Resource use efficiency in hybrid brinjal seed production

Explanatory Variables	Parameters	Elasticity coefficients	Standard error	MVP:MFC
Intercept	a	-11.6675		
Seedlings	b_1	0.2631*	0.1069	61.0561:1
Farm Yard Manure	b_2	0.0690	0.0493	9.9948:1
Human labour	b_3	1.7177**	0.3285	5.6406:1
Bullock & Machine charges	b_4	0.0611	0.0623	1.5548:1
Fertilizers & Micronutrients	b_5	-0.0376	0.0501	-2.6692:1
Plant protection chemicals	b_6	0.0017	0.0244	0.0748:1
Irrigation	b_7	0.1032*	0.0481	24.4042:1
Stakings & gunny threads	b_8	0.0093	0.0351	0.3459:1
Polythene mulch	b_9	0.0691	0.0584	2.1851:1
Coefficient of multiple determination (R^2)	0.88			
Returns to scale (∑bi)	2.26			

Note: ** Significance at 1% probability level
* Significance at 5% probability level

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