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An Economic Analysis of Hybrid Water Melon Seed Production in Koppal District of Karnataka

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ABSTRACT

The present study was conducted in Koppal district of Karnataka. This study is based on primary data collected from a sample of 32 farmers through personal interview method. Tabular analysis, budgeting technique and Cobb-Douglas production function were applied to study the effect of various inputs on hybrid water melon seed production. Results revealed that per acre labour utilization was 149.82 mandays. Per acre total cost was found to be ₹ 67,110, which includes variable cost (₹ 62,553) and fixed cost (₹ 4,557). Among variable costs, expenditure on human labour was highest (₹ 26,941). Per acre gross return, net return over variable cost and net return over total cost realised were ₹ 1,14,859, ₹ 52,306 and ₹ 47,749 respectively. Cost of production was ₹ 754.89 per kg seeds and return per rupee of expenditure was ₹ 1.71. The output elasticities of human labour (0.81) found to be significant at one per cent. The output elasticities of bullock and machine charges (0.45), irrigation (0.86) and FYM (-0.11) were found to be significant at five per cent. The coefficient of multiple determination (R^2) was 0.86. The sum of elasticities (∑bi) was 1.43 which indicated an increasing return to scale. The ratio of MVP to MFC in case of human labour, bullock and machine charges, fertilizers and micronutrients, and irrigation, were 3.46, 19.91, 2.07 and 77.82 respectively.

Keywords: *Cost, Hybrid seed, Human labour, Input use, Returns*

INTRODUCTION

Seed is a basic input among all inputs for sustainable agricultural production. It is found that quality of seed accounts for 20-25 per cent to productivity. The importance of quality seed has been realized by mankind long ago. The need for a good viable seed for prosperity of human race is mentioned in Rigveda of ancient India. It is mentioned in the primitive manusmriti as "Subeejam Sukshetre Jayate Sampadyate" which literally means "A good seed in a good field produces abundantly" (Poonia, 2013).

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India is the second largest vegetable seed producing country first being China. Due to technological breakthrough, availability of quality seeds the total production and economic value of vegetables has doubled in India during a period from 2002 to 2016. India is likely to record highest ever production of horticulture produce, including fruits and vegetables in 2016-17. The total production is estimated at 295 million tonnes which is 3.2 per cent higher than the production in 2015-16. The estimate shows that the current year will be the fifth straight year when horticulture production in the country will outstrip the production of food-grains (https://timeso findia.indiatimes.com). India's share in world's vegetables production is 14 per cent. Even though being the world's second largest producer of vegetables, India lags far behind in their 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. This technology, although capital and labour-intensive, 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 foreign exchange for the country, and thus adds substantially to improve the economic status of the farm families (Sudha et al., 2006). Karnataka produces nearly 90 per cent of the total hybrid vegetable seeds in India. Today Indian seed industry has a turnover of ₹ 16,000 to ₹ 18,000 crores. It is globally sixth largest seed industry in terms of size (Indian seed congress, 2017). Commercial seed production in vegetables is gaining popularity with the farmers and private seed companies due to its higher profitability. Recently area under vegetable seeds production is increasing. The present paper, therefore attempts to bring out a clear picture of costs and returns in hybrid water melon seed production and extent of utilization of resources in the study area. The results of the study would help the planners and policy makers in formulating suitable agricultural policies and also further throw light on the path for future line of research in the area of vegetables hybrid seed production.

MATERIALS AND METHODS

The study is based on primary data on input utilisation both in terms of physical quantity and monitory value, cost, returns, selling price and yield data compiled from selected sample watermelon producing farmers for the year 2015-16 in the study area with the help of pre-tested schedule through personal interview method. In the first stage, Koppal district was selected purposively in north Karnataka and in the second stage, Kushtagi and Yalburga taluks were selected purposively as they were major watermelon seed producing taluks in the district. In the third stage, two villages were selected randomly from each taluk. Finally, multistage stratified random sampling technique was adopted for the selection of the eight sample watermelon seed producing farmers from each selected villages, which makes a total sample size of 32 farmers.

Statistical tools

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 work out the input use pattern, budgeting technique was used to estimate the costs and returns in hybrid watermelon seed production, while Cobb-Douglas production function was employed to study the effect of various inputs on hybrid water melon seed production (Nagaraj, 2014).

RESULTS AND DISCUSSION

Labour use pattern in hybrid watermelon seed production

The results of the per acre labour use pattern in hybrid water melon seed production are presented in Table-1. Total of 149.82 mandays were employed for different activities of watermelon seed production which required

for 58.22 mandays of male and 91.60 mandays of female labour. Among this majority of the labours (77.58 mandays) have been employed for pollen collection and pollination this indicates that pollen collection and pollination is a specialized activity requires greater care, hence consumed more number of labours. Among all seed production activities, harvesting of watermelon fruit has consumed maximum number of labour (9.38 mandays), followed by bed preparation and mulching (7.78 mandays), seed extraction (7.65 mandays), application of plant protection chemicals(7.38 mandays), FYM transportation and application (6.97 mandays), application of fertilizers (6.74 mandays),seed drying and cleaning (5.24 mandays), rouging (5.23 mandays), irrigation (5.16 mandays), weeding (5.01 mandays), seedlings transplantation (4.68 mandays) and land preparation (1.03 mandays).

Input use pattern in hybrid watermelon seed production

Per acre input use pattern is presented in Table-2. It is evident from the table that on an average the farmers used 456 male and 1,291 female seedlings in order to maintain optimum plant population. The quantity of FYM applied was 4.97 tonnes per acre. About 224.84 kg of different chemical fertilizers were applied to ensure the vigour and healthy growth of the plants. Around 4.02 kg of micronutrients were used. On an average 3.58 litres of plant protection chemicals was used to control pests and disease menace. Around 5,258 butter papers were used to cover the stigma before and after pollination, 4.59 kg of threads and 62.53 kg of polythene mulch were used to suppress the weed infestation. On an average 149.82 mandays of human labour, 2.16 pairdays of bullock labour and 2.43 hours of machine labour employed per acre.

Cost structure

The per acre total cost of hybrid water melon seed production is shown in Table-3. It was found that total cost was ₹ 67,110, out of which variable cost accounted a lion share of 93.2 per cent of the total cost (₹ 62,553) followed by fixed cost amounted to ₹ 4557 (6.79% of the total cost). Whereas results of Ali Ahmad (2017) revealed that per acre total cost of commercial cultivation of watermelon crop was ₹ 17,941. This clearly shows that cost of cultivation was higher in hybrid seed production than in commercial cultivation of watermelon.

Among the variable cost, cost spent on human labour was the major item, which amounted to ₹ 26,941 (40.14% of the total cost). This was one of the important aspects of hybrid watermelon seed production activity in the study area, which incurs maximum cost due to higher wage rate and since it is a labour intensive activity which provides employment to rural masses. There is a need to improve efficiency of labours by providing further skill oriented trainings ultimately to reduce labour cost. This is followed by cost on mulching ₹ 10,135 (15.10% of the total cost) since polythene mulching used only for one seed production season which forms another important cost item, cost on fertilizers and micronutrients together accounts ₹ 6,536 (9.74% of the total cost), cost on PPC was ₹ 6,366 (9.49% of the total cost), interest on working capital at seven per cent interest rate was ₹ 4,092 (6.10% of the total cost), cost on cost FYM was ₹ 2,707 (4.03% of the total cost) and cost on bullock labour ₹ 1,378 (2.05% of the total cost). Among fixed cost, rental value of land was the major cost, which accounts ₹ 3,426 (5.11% of the total cost) and depreciation was ₹ 679 (1.01% of the total cost). Land revenue is included in the rental value of land. The interest on fixed capital at 11 per cent interest rate was ₹ 452 (0.67% of the total cost).

Returns structure

Returns structure in water melon hybrid seed production is presented in Table-3. It is evident from the table that average yield of seeds obtained was 88.90 kg per acre. Price realised for seeds was ₹ 1,292 per kg. Gross return, net return over variable cost and net return over total cost obtained were ₹ 1,14,859, ₹ 52,306 and ₹ 47,749 respectively. Cost of production was ₹ 754.89 per kg seeds. Return per rupee of investment was ₹ 1.71 indicates that hybrid seed production in water melon highly profitable. Whereas results of Ali Ahmad (2017) revealed that per acre gross return and net return in commercial cultivation

of watermelon crop were ₹ 31,732, and ₹ 13,791 respectively in Allahabad district of Uttar Pradesh. This clearly indicates that hybrid seed production is more profitable than commercial cultivation of watermelon.

Production elasticities of inputs in watermelon hybrid seed production

The estimated coefficients of Cobb-Douglas production function are presented in Table-4. The output elasticity of human labour (0.81) was positive and found to be significant at one per cent level of probability. The output elasticities of bullock and machine charges (0.45) and irrigation (0.86) were positive and found to be significant at five per cent level of probability. Positive elasticity coefficients indicate that increase in the use of these inputs would result in increased efficiency of hybrid water melon seed production. The output elasticity of FYM (-0.11) was negative but found to be significant at five per cent level indicating negative influence on yield withdrawing of some units of these inputs would be profitable. The output elasticity of fertilizers and micro nutrients (0.01) was positive and found to non-significant hence it would not be profitable to increase the use of this input. The output elasticities of PPC (-0.02), mulching (-0.08), butter paper and gunny threads (-0.0069) and seedlings (-0.58) were negative and found to be non-significant indicating over usage of these resources. Whereas in the study conducted by Santosh (2017) on human labour, seeds, and irrigation were found to be significant at five per cent level of probability.

The coefficient of multiple determination (R^2) was 0.86. This indicates that 86 per cent of the variation in the production of hybrid water melon is explained by the variables included in the function. The sum of elasticities (∑bi) was 1.43 which indicated an increasing return to scale *i.e.*, simultaneous increase in all the inputs by one per cent would increase the output by 1.43 per cent. Whereas in the study of Santosh (2017) revealed that R^2 and returns to scale were found to be 0.84 and 0.75 respectively.

Resource use efficiency in hybrid watermelon seed production

The MVP to MFC ratios in hybrid water melon seed production are presented in Table-4. It can be seen from the table that MVP to MFC ratio for human labour, bullock and machine labour, fertilizers and micro-nutrients, irrigation were observed to be more than unity indicated that these inputs are under-utilized and hence there is an ample scope to increase in the use of these inputs in order to reap the greater returns from watermelon seed production. Whereas MVP to MFC ratios for seedlings, farm yard manure, plant protection chemicals, stakings and gunny thread and mulching were found to be less than unity indicated that these inputs were over-utilized than optimum level. By withdrawing some units of these inputs and thereby expenditure on use of these inputs could be reduced.

Table 1: Labour use pattern in hybrid water melon seed production

(Per acre)

Sl. No.	Type of operation	Male (mandays)	Female (converted mandays)	Total human labour
1.	Land preparation	1.03	0.00	1.03
2.	Transportation & application of FYM	6.97	0.00	6.97
3.	Bed preparation and mulching	7.78	0.00	7.78
4.	Transplanting	1.50	3.18	4.68
5.	Weeding	1.59	3.42	5.01
6.	Fertilizer application	4.94	1.80	6.74
7.	Pollen collection and pollination	8.06	69.51	77.58
8.	Irrigation	5.16	0.00	5.16
9.	Roguing	2.47	2.76	5.23
10.	Spraying of chemicals	7.38	0.00	7.38
11.	Harvesting	6.03	3.35	9.38
12.	Seed extraction	3.13	4.52	7.65
13.	Seed drying and cleaning	2.19	3.06	5.24
	Total	**58.22**	**91.60**	**149.82**

Table 2: Input use pattern in hybrid water melon seed production

(Per acre)

Sl. No.	Particulars	Unit	Quantity
1.	Seedlings		
a.	Male	numbers	456
b.	Female	numbers	1291
2.	FYM	t	4.97
3.	Chemical fertilizers		
a.	DAP	kg	105.31
b.	Complex fertilizers	kg	63.28
c.	Other fertilizers*	kg	56.25
	Sub total	kg	224.84
4.	Micronutrients	kg	4.02
5.	Plant protection chemicals	L	3.58
6.	Butter paper	numbers	5258
7.	Threads	kg	4.59
8.	Polythene Mulch	kg	62.53
9.	Labour		
a.	Human labour	mandays	149.82
b.	Bullock labour	pairdays	2.16
c.	Machine labour	hours	2.43

Note: 1. * other fertilizers like Urea, MoP, SSP etc.

Table 3: Cost and returns structure in hybrid water melon seed production

(Per acre)

I. Cost structure			
Sl. No.	**Particulars**	**Amount (₹)**	**Per cent**
A.	**Variable cost**		
1.	Seedlings	646	0.96
2.	Farmyard manure	2,707	4.03
3.	Chemical fertilizers	**5,374**	**8.01**
4.	Micronutrients	1,162	1.73
5.	Plant protection chemicals	6,366	9.49
6.	Butter paper and threads	1,252	1.87
7.	Polythene mulch	10,135	15.10
8.	Irrigation charges	1,279	1.91
9.	Labour		
a.	Human labour	26,941	40.14
b.	Bullock labour	1,378	2.05
c.	Machine labour	1,220	1.82
10.	Interest on working capital (@ 7%)	4,092	6.10
	Subtotal (I)	**62,553**	**93.21**
B.	**Fixed cost**		
1.	Rental value including land revenue	3,426	5.11
2.	Depreciation	679	1.01
3.	Interest on fixed capital (@ 11%)	452	0.67
	Subtotal (II)	**4,557**	**6.79**
	Total cost (I+II)	**67,110**	**100.00**
II. Returns structure			
Sl. No.	**Particulars**	**Unit**	**Amount**
1.	Output (seeds)	kg	88.90
2.	Price of seeds	₹ /kg	1,292
3.	Gross return	₹	1,14,859
4.	Net return over variable cost	₹	52,306
5.	Net return over total cost	₹	47,749
6.	Cost of production	₹ /kg	754.89
7.	Return per rupee of expenditure	₹	1.71

Table 4: Resource use efficiency in hybrid water melon seed production

Explanatory Variables	Parameters	Coefficients	Standard error	MVP:MFC
Intercept	a	-1.5888		
Seedlings	b_1	-0.5853	0.6944	-104.0660:1
Farm Yard Manure	b_2	-0.1163*	0.0391	-4.9346:1
Human labour	b_3	0.8129**	0.3326	3.4656:1
Bullock & Machine charges	b_4	0.4504*	0.1046	19.9124:1
Fertilizers & Micronutrients	b_5	0.1179	0.1084	2.0712:1
Plant protection chemicals	b_6	-0.0264	0.0845	-0.4763:1
Irrigation	b_7	0.8666*	0.1860	77.8239:1
Butter paper and threads	b_8	-0.0069	0.2175	-0.6330:1
Polythene mulch	b_9	-0.0851	0.2249	-0.9644:1
Coefficient of multiple determination (R^2)		0.86		
Returns to scale (∑bi)		1.43		

Note: 1. **- Significance at 1% probability level,
2. *- Significance at 5% probability level,

CONCLUSION

The present study clearly depicts that hybrid watermelon seed production is practiced mostly by large and medium farmers in the study area. Hybrid seed production in watermelon is a labour intensive activity which requires skilled labours especially for pollen collection and pollination and is also an input intensive activity requires more quantity of physical inputs like chemical fertilizers, pesticides *etc*. Hybrid watermelon seed production is highly profitable venture and capital intensive enterprise requires huge amount of investment as compared to commercial seed production on area basis. Inputs like plant protection chemicals, mulching, butter paper and gunny threads and seedlings were found to be over-utilized and reduction in the use of these resources could reduce the cost to larger extent in order to reap the benefits.

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