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Comparative economics of seed production vis - à - vis grain production of pigeonpea in Karnataka, India

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ABSTRACT

The present study was based on primary data collected for 100 farmers from Gulbarga district of Karnataka during the agricultural year 2013-14. Tabular and discriminant function analysis was used in the present study. The analysis of data shows that the total cost of cultivation in pigeonpea seed production was around 23 per cent higher than grain production. The variable cost was comparatively higher in seed production (₹ 26936 per ha) over grain production (₹ 20698 per ha). The gross return was about 32 per cent higher in seed production than grain production and net return from seed production of pigeonpea was 44 per cent higher than grain production. The discriminant analysis indicated that gross return with 55.88 per cent followed by seed (18.52 per cent), human labour (8.35 per cent), manures and fertilizers (7.01per cent), bullock and machine labour (5.99 per cent), plant protection chemicals (4.26 per cent) contributed to discriminate between the seed and grain production of pigeonpea. The net return from pigeonpea seed production was encouraging, therefore the area under seed production may be increased for higher profitability and timely supply of quality seed to the farmers.

Key words: Discriminant analysis, Economics, Pigeonpea, Seed production.

INTRODUCTION

Seed is a crucial, vital, basic and important input for attaining sustained growth in agriculture production and productivity. Quality seed production is a specialised activity. The general farm produce retained for seed cannot be substituted for quality seed, farm saved seed generally lacks genetic vigour and has poor germination (Singh *et al*., 1990). A sustained increase in agriculture production and productivity has dependent on the development of new improved variety, timely and adequate supply of quality seed to the farmers. It is estimated that the direct contribution of quality seed alone to the total production is about 15-20 per cent depending upon the crop and it can be further raised up to 40 per cent with effective management of other inputs (Anonymous, 2007).

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is one of the protein rich legumes of the semi-arid tropics grown throughout the tropical and sub-tropical regions of the world. In India its major area is lying between 14^0 and 28^0 N latitude, where majority of the world's pigeonpea is produced (Pramod *et al*., 2010). According to FAO statistics, worldwide pigeonpea was grown in about 4.23 million hectares and its production was 4.68 million tons having productivity of 751 kg/ha in 2013. India is the largest producer of pigeonpea accounting 66 per cent of total production of the world during the year 2013 (FAO STAT, 2013). Pigeonpea ranks second after chickpea among all the pulses in the country and normally cultivated during *kharif* season. In India, it occupies an area of about 3.81 million hectares, producing 3.07 million tons with an average productivity of 806 kg/ha. Pigeonpea is also important crop of Karnataka contributing around 18 per cent and 12 per cent to total area and production of pigeonpea in the country respectively (Anonymous, 2013).

There are several studies pertaining to cost of cultivation of pigeonpea for grain production (Kumar and Bourai, 2012; Pramod *et al*., 2010; Sahu and Jiyawan, 2012; Sreelakshmi *et al*., 2012; Tuppad *et al*., 2012), but only a few studies related to cost of pigeonpea seed production (Jamadar *et al*., 2014). Hence, the present study is undertaken with the following objectives to analyze the economics of pigeonpea seed production vis-à-vis grain production and to specify the variables that are discriminating the seed production from grain production.

MATERIALS AND METHODS

The study is based on primary data collected from Gulbarga district of Karnataka. The district Gulbarga has been selected purposively as the district has highest area under pigeonpea in the state which was around 56 per cent of total area under pigeonpea in the state during 2009-10 (Anonymous, 2011). The list of certified seed growers of pigeonpea in Gulbarga district have been obtained from Karnataka State Seed Certification Agency, Bangalore. From the list, fifty certified seed growers of pigeonpea have been

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selected randomly from fifteen villages. For comparison study with grain production of pigeonpea again fifty grain producers of pigeonpea selected randomly from the above selected villages. Thus, the total number of selected farmers (grain and certified seed producer of pigeonpea) was one hundred. The primary data for the study were collected by personnel interview with the respondents using a well-structured and pre-tested interview schedule for the agricultural year 2013-14. Farm management Cost concepts like Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2 and Cost C_3 were used to derive different income measures and benefit-cost ratio.

The linear discriminant function analysis was used to identify the variables that are important in discriminating between two group of production *i.e.* seed and grain production. In multivariate analysis, linear discriminant function, which is better than any other linear function, will discriminate between any two chosen classes (Dillion and Goldstein, 1984). The concept underlying the discriminant function analysis is that, linear combinations of the independent variables are formed and serve as the basis for classification. Thus, the information from multiple independent variables is summarized in a single index. In the present study linear discriminant function of the following form was employed to know the relative importance of different variables in discriminating between the two groups of farms of equal size, *viz.*, seed and grain production of pigeonpea.

$$Z = \sum_{i=1}^{p} Li\,Xi$$

Where,

Z = Total discriminant score for seed and grain production,

X_i = Variables selected to discriminate the two groups (i = 1,2,3,……, n),

L_i = Linear discriminant coefficients of the variables estimated from the data.

Mahalanobis D^2 statistic was used to measure the discriminating distance between the two groups,

$$D^2 = \sum_{i=1}^{n} Li\,di$$

Where,

n = Total number of cases,

L_i = Inverted matrix of the coefficients of the discriminant function,

d_i = Mean difference of the variables.

The significance of D^2 was tested by applying the following F test.

$$\frac{(n-1-p)(n1\,n2)}{(n-2)(n)}\,D^2 \sim F \infty (p, n-p-1)$$

Where,

n_1 = Number of individuals in the seed production,

n_2 = Number of individuals in the grain production,

$n = n_1 + n_2$.

The Z scores for each group have been calculated as:

For seed production:

$$Z1 = \sum_{i=1}^{p} Li\,X1i$$

For grain production:

$$Z2 = \sum_{i=1}^{p} Li\,X2i$$

The critical mean discriminant score was obtained as

$$Z = (Z_1 + Z_2)/2,$$

For each individual Zi value was calculated as follows:

$$Zi = \sum_{i=1}^{p} Li\,Xi$$

If the individual Zi value is more than Z, the individual belongs to the seed production, otherwise grain production.

RESULTS AND DISCUSSION

Economic comparison is essential to test the profitability and viability of any activity. Therefore, economics of seed production vis-à-vis grain production has been calculated and compared, so as to analyze the feasibility of seed production over grain production. The present analysis on cost of cultivation was worked out on per hectare basis separately for seed production and grain production.

The item-wise cost of cultivation of seed and grain production of pigeonpea has been presented in Table 1. The table reveals that human labour occupied the major share (32.46 and 32.30 per cent) of total cost of ₹ 39436 per ha and ₹ 32198 per ha of seed production and grain production of pigeonpea, respectively. The higher human labour requirement in seed production was mainly due to activities like rouging, gap filling etc. The other items involved in production of pigeonpea seed was bullock and machine labour (12.29 per cent of total cost), manures and fertilizers (8.00 per cent), plant protection chemicals (6.85 per cent), seed certification charges (3.17 per cent) and cost of seed (2.49 per cent). In total cost of cultivation, variable costs took major share of 68.30 per cent in seed production as compared to 64.28 per cent in grain production. The variable cost was comparatively higher in seed production

Table 1: Item-wise cost comparison of seed and grain production in pigeonpea

(₹/ha)

Items	Seed production	Grain production
Seed	981(2.49)	744(2.31)
Human labour	12800(32.46)	10400(32.30)
Bullock & machine labour	4846(12.29)	4050(12.58)
Manures & fertilizers	3155(8.00)	2677(8.31)
Irrigation	400(1.01)	00(0)
Plant protection chemicals	2703(6.85)	2224(6.91)
Seed certification charges	1250(3.17)	00(0)
Interest on working capital	801(2.03)	603(1.87)
Total variable cost (₹)	26936(68.30)	20698(64.28)
Total fixed cost (₹)	12500(31.70)	11500(35.72)
Total cost	39436(100.00)	32198(100.00)

Note: Figures in parentheses indicate per cent to total cost

(₹ 26936 per ha) over grain production (₹ 20698 per ha). The total cost of cultivation in pigeonpea seed production was around 23 per cent higher than grain production.

Cost of cultivation according to various cost concepts as presented in Table 2, reveals that all the costs were higher in seed production over grain production in pigeonpea. The seed grower has to strictly adhere to the recommended cultural practices to ensure genetic purity as laid down by the seed certification agency. Seed production plot must be weed free and off types plants need to be removed manually to maintain genetic purity. Proper drying of seeds and preliminary processing is another special operation in seed production. All these operations required additional labour. Moreover, certification charges are an additional expense in seed production. Hence, cost of cultivation was higher in seed production as compared to the commercial production. The cost C_1, C_2 and C_3 were higher by around 32, 23 and 23 per cent in pigeonpea seed production in comparison to grain production respectively.

Table 2: Cost and returns in pigeonpea seed and grain production according to cost concept and income measures (₹ /ha)

Sl.	Items	Seed production	Grain production
Cost concepts			
1	Cost A_1	23996	15718
2	Cost A_2	23996	15718
3	Cost B_1	24736	15998
4	Cost B_2	36236	26998
5	Cost C_1	27936	21198
6	Cost C_2	39436	32198
7	Cost C_3	43380	35418
Income measures			
8	Yield		
a	Seed / Grain	65000	52700
b	Rejected seed	5100	-
c	By-product	3200	3000
9	Gross income	73300	55700
10	Net income (9-7)	29920	20282
11	Family labour income (9-4)	37064	28702
12	Farm business income (9-1)	49304	39982
13	Farm investment income (9-1+3-5)	46104	34782
14	Benefit cost ratio (9/7)	1.69	1.57

The family labour income, farm business income and farm investment income were higher by around 29, 23 and 33 per cent in pigeonpea seed production in comparison to grain production respectively. Seed production gives higher returns with higher BC ratio compared to grain production. The gross return was about 32 per cent higher in seed production than grain production and net return from seed production of pigeonpea was 44 per cent higher than grain production. The BC ratio was 1.69 in case of pigeonpea seed production as compared to 1.57 in grain production.

Linear discriminant function was used to know the relative importance of different variables in discriminating between two groups. The results of discriminant function analysis of two different groups *i.e.* seed production and grain production has been presented in Table 3. The variables considered in the analysis are useful in distinguishing the two groups of farms in pigeonpea cultivation as the D^2 value was found to be statistically significant at one per cent level of probability. The relative importance of the discriminators as calculated through their per cent contribution to total distance reveals that gross return with 55.88 per cent followed by seed (18.52 per cent), human labour (8.35 per cent), manures and fertilizers (7.01 per cent), bullock and machine labour (5.99 per cent), plant protection chemicals (4.26 per cent) contributed to discriminate between the seed and grain production of pigeonpea. It can be inferred that seed and gross returns were the major contributing factors to discriminate between the two groups of production. This indicated that there were significant differences in gross return between seed and grain production of pigeonpea.

CONCLUSIONS AND IMPLICATIONS

The analysis showed that the total cost of cultivation in pigeonpea seed production was around 23 per cent higher than grain production. Further, the gross return was about 32 per cent higher in seed production than grain production and net return from seed production of pigeonpea was 44 per cent higher than grain production. The discriminant analysis indicated that gross return with 55.88 per cent followed by seed (18.52 per cent), human labour (8.35 per cent), manures and fertilizers (7.01 per cent),

Table 3: Discriminant variables in pigeonpea production

Items	Mean (000 ₹)		Mean difference (d_i)	Discriminant coefficient (L_i)	L_i*d_i	Percent contribution to the total distance
	Seed production	Grain production				
Seed (X_1)	0.981	0.744	0.237	0.487	0.115	18.52
Manures and fertilizers (X_2)	3.155	2.677	0.478	0.091	0.044	7.01
Human labour (X_3)	12.800	10.400	2.400	0.022	0.052	8.35
Plant protection chemicals (X_4)	2.703	2.224	0.479	0.055	0.027	4.26
Bullock and Machine labour (X_5)	4.846	4.050	0.796	0.047	0.037	5.99
Gross returns (X_6)	73.300	55.700	17.600	0.020	0.348	55.88

D^2 = 0.624*** ; Z = 2.561 ; Z_1 = 2.872 ; Z_2 = 2.249 ; F statistics = 25.68

*** indicates significance at 1 per cent level of probability

bullock and machine labour (5.99 per cent), plant protection chemicals (4.26 per cent) contributed to discriminate between the seed and grain production of pigeonpea. The net return from pigeonpea seed production is encouraging, therefore the area under seed production may be increased for higher profitability and timely supply of quality seed to the farmers. The farmers may be encouraged to grow quality seed of pigeonpea.

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