

A Study on Comparative Economics of Grain and Seed Production of Groundnut in Karnataka, India

ABSTRACT

The present study was based on primary data collected for 100 farmers from Chitradurga district of Karnataka during the agricultural year 2013-14. Tabular analysis and discriminant function analysis was used in the present study. The analysis of data reveals that human labour occupied the major share (27.07%) of total cost in seed production and bullock and machine labour occupied the major share (29.38%) of total cost in grain production of groundnut. The higher human labour requirement in seed production was mainly due to activities like rouging, gap filling etc. The variable cost was comparatively higher in seed production (Rs. 25745.0 per ha) over grain production (Rs. 20752.0 per ha). The total cost of cultivation in groundnut seed production was around 18% higher than grain production. The gross return was about 27% higher in seed production than grain production and net return from seed production of groundnut was 44% higher than grain production. The BC ratio was 1.73 in case of groundnut seed production as compared to 1.60 in grain production. The discriminant analysis indicated that human labour with 45.56% followed by gross return (35.83%), seed (17.50%), manures and fertilizers (0.69%), bullock and machine labour (0.42%) contributed to discriminate between the seed and grain production of groundnut. The net return from groundnut 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, groundnut, 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, as 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

32 seed alone to the total production is about 15-20% depending upon the crop and it can be further
33 raised up to 40% with effective management of other inputs (Anonymous, 2007).

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35 Groundnut (*Arachis hypogaea* L.) is the 6th most important oil seed crop in the world. It contains
36 48-50% oil, 26 -28% protein and 11-27% carbohydrate, minerals and vitamins (Mukhtar, 2009).
37 According to FAO statistics, worldwide groundnut was grown in about 25.67 million hectares and its
38 production was 42.31 million tons having productivity of 1648 kg/ha during the year 2014. India is the
39 second largest producer of groundnut after China in the world. (FAOSTAT, 2016). Developing country
40 share in global production of groundnut is around 95% while Asia's share is around 68% (ICRISAT,
41 2016).

42 It is estimated that nine oilseed crops namely soybean, rapeseed-mustard, groundnut, sesame,
43 castor, sunflower, niger, linseed and safflower accounted for an area of 28.05 million hectares with
44 the production of 32.75 million tons during 2013-14. Groundnut ranks second in terms of production
45 amongst all nine oilseed crops and it is an important leguminous oilseed crop grown in India. It
46 occupies an area of 5.51 million ha with production 9.71 million tons and productivity 1764 kg/ha
47 during 2013-14 (IIOR, 2016). It is grown in semi-arid regions, especially in the states of Gujarat,
48 Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra (Basu and Singh, 2004). In India, 80% of
49 groundnut is grown during *kharif* season under rainfed conditions (Govindaraj and Mishra, 2011).

50 Groundnut is an important crop of Karnataka contributing around 13% and 7% to area and production
51 of groundnut in the country respectively during 2011-12 (Anonymous, 2013). Seed of groundnut has
52 major share in its cost of cultivation, therefore the economics of groundnut seed production has
53 impacted both seed producers as well as its users. There are several studies pertaining to cost of
54 cultivation of groundnut for grain production (Girei et al., 2013; Kayarkanni, 2014; Khorne et al., 2014;
55 Mundinamani et al., 1989; Narayanamoorthy, 2013; Reddy and Shenoy, 2013; Usman et al., 2013).
56 But only a few studies related to cost of groundnut seed production (Dudhat, et al., 2013). Hence, the
57 present study is undertaken with the objective to analyze the economics of groundnut seed production
58 *vis-à-vis* grain production and to specify the variables that are discriminating the seed production from
59 grain production.

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61

62 **METHODOLOGY**

63 The study is based on primary data collected from Chitradurga district of Karnataka. The district
64 Chitradurga has been selected purposively as the district has highest area under groundnut
65 cultivation in the state which was 15.15% of total area under groundnut cultivation in the state during
66 2009-10 (Anonymous, 2011). The list of certified seed growers of groundnut in Chitradurga district
67 have been obtained from Karnataka State Seed Certification Agency, Bangalore. From the list fifty
68 certified seed growers of groundnut have been selected randomly from five villages. For comparison
69 study with grain production of groundnut again forty one grain producers of groundnut selected
70 randomly from the above selected five villages and nine from other two neighbouring villages as
71 sufficient groundnut grain producers were not available in the said villages. Thus, the total number of
72 selected farmers (grain and certified seed producer of groundnut) was one hundred.

73 Data collection

74 Primary data were collected by personnel interview with the respondents using a well-structured and
75 pre-tested interview schedule. Data on socio-economic parameters, various inputs used in the grain
76 and seed production of groundnut and their costs and returns were collected for the agricultural year
77 2013-14. Tabular analysis was used to compare the different values of farm economy and other
78 aspects of farm business and weighted average was used for average analysis.

79 Cost concept

80 $\text{Cost } A_1 = \text{All the variable costs excluding family labour cost and including interest on working capital}$

81 $\text{Cost } A_2 = \text{Cost } A_1 + \text{Rent paid for leased in land}$

82 $\text{Cost } B_1 = \text{Cost } A_1 + \text{Interest on value of owned fixed capital (other than land)}$

83 $\text{Cost } B_2 = \text{Cost } B_1 + \text{Rental value of owned land} + \text{Rent paid for leased in land}$

84 $\text{Cost } C_1 = \text{Cost } B_1 + \text{Imputed value of family labour}$

85 $\text{Cost } C_2 = \text{Cost } B_2 + \text{Imputed value of family labour}$

86 $\text{Cost } C_3 = \text{Cost } C_2 + 10\% \text{ of cost } C_2 \text{ to account for the value of management input of the farmers}$

87 Income measures

88 $\text{Net income} = \text{Gross income} - \text{Cost } C_3$

89 $\text{Family labour income} = \text{Gross income} - \text{Cost } B_2$

90 $\text{Farm business income} = \text{Gross income} - \text{Cost } A_1$

91 $\text{Farm investment income} = \text{Farm business income} - \text{imputed value of family labour}$

92 Benefit cost ratio = Gross income / Cost C_3

93 **Discriminant function analysis**

94 The linear discriminant function analysis was used to identify the variables that are important in
95 discriminating between two groups of production i.e. seed and grain production. In multivariate
96 analysis, linear discriminant function, which is better than any other linear function, will discriminate
97 between any two chosen classes (Dillion and Goldstein, 1984). The concept underlying the
98 discriminant function analysis is that, linear combinations of the independent variables are formed and
99 serve as the basis for classification. Thus, the information from multiple independent variables is
100 summarized in a single index.

101 In the present study linear discriminant function of the following form was employed to know the
102 relative importance of different variables in discriminating between the two groups of farms of equal
103 size, viz., seed and grain production of groundnut.

104

$$Z = \sum_{i=1}^n L_i X_i$$

105

106

107 Where,

108 Z = Total discriminant score for seed and grain production,

109 X_i = Variables selected to discriminate the two groups ($i = 1, 2, 3, \dots, n$),

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

111

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

113

$$D^2 = \sum_{i=1}^n L_i d_i$$

114

115

116 Where,

117 n = Total number of cases,

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

119 d_i = Mean difference of the variables.

120

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

122

123
$$\frac{(n-1-p)(n_1 n_2)}{(n-2)(n)} D^2 \sim F_{\infty}(p, n-p-1)$$

124

125 Where,

126 n_1 = Number of individuals in the seed production,

127 n_2 = Number of individuals in the grain production,

128 $n = n_1 + n_2$.

129 The Z scores for each group have been calculated as:

130 For seed production:

131
$$Z_1 = \sum_{i=1}^F L_i X_{1i}$$

132 For grain production:

133
$$Z_2 = \sum_{i=1}^F L_i X_{2i}$$

134 The critical mean discriminant score was obtained as

135
$$Z = (Z_1 + Z_2)/2,$$

136 For each individual Z_i value was calculated as follows:

137
$$Z_i = \sum_{i=1}^F L_i X_i$$

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

140 RESULTS AND DISCUSSION

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

The item-wise cost of cultivation of seed and grain production of groundnut has been presented in Table 1. The table reveals that human labour occupied the major share (27.07%) of total cost of Rs. 33245.0 per ha in seed production and bullock and machine labour occupied the major share (29.38%) of total cost of Rs. 28252.0 per ha in grain production of groundnut. The higher human labour requirement in seed production was mainly due to activities like rouging, gap filling etc. This result is reiterated with Reddy and Shenoy (2013) who reported that due to knowledge and adoption gap, its results in lower yield and higher cost of cultivation. The other items involved in production of groundnut seed was bullock and machine labour (26.47% of total cost), cost of seed (10.95%), manures and fertilizers (8.42%), and seed certification charges (3.01%). The higher share of bullock and machine labour was due to less mechanization at field level and this can be reduced by increasing mechanization in cultivation operation. In total cost of cultivation, variable costs took major share of 77.44% in seed production as compared to 73.45% in grain production. The higher share of fixed cost in total cost of cultivation is mainly due to rental value of own land (opportunity cost). The variable cost was comparatively higher in seed production (Rs. 25745.0 per ha) over grain production (Rs. 20752.0 per ha). The total cost of cultivation in groundnut seed production was around 18% higher than grain production. This result is reiterated with Sowjanya (2011) where he reported that the total cost of cultivation per ha. of rainfed groundnut crop was Rs. 34638.86 on seed farm and Rs. 26827.0 on commercial farm. The seed and commercial farm realized a gross income of Rs. 48701.0 and 36412.0 per ha. respectively. The net income was high on seed farm (Rs. 14062.14) compared to Rs. 9585.0 per ha. on commercial farm.

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

(Rs./ha)

Sl.	Items	Seed production	Grain production
1	Seed	3640 (10.95)	3115 (11.02)
2	Human labour	9000 (27.07)	5880 (20.81)
3	Bullock and machine labour	8800 (26.47)	8300 (29.38)
4	Manures and fertilizers	2800 (8.42)	3050 (10.08)
7	Seed certification charges	1000 (3.01)	00 (0)
8	Interest on working capital	505 (1.52)	407 (1.44)
9	Total variable cost (Rs.)	25745 (77.44)	20752 (73.45)
10	Total fixed cost (Rs.)	7500	7500

		(22.56)	(26.55)
11	Total cost	33245 (100.00)	28252 (100.00)

Note: Figures in parentheses indicate % to total cost.

Cost of cultivation according to various cost concepts was presented in Table 2 which reveals that all the costs were higher in seed production over grain production in groundnut. 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-type 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 23, 18 and 18% in groundnut seed production in comparison to grain production respectively. The family labour income, farm business income and farm investment income were higher by around 35, 27 and 30% in groundnut 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 27% higher in seed production than grain production and net return from seed production of groundnut was 44% higher than grain production. The BC ratio was 1.73 in case of groundnut seed production as compared to 1.60 in grain production.

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

Sl.	Items	Seed production	Grain production
Cost concepts			
1	Cost A_1	21305	16636
2	Cost A_2	21305	16636
3	Cost B_1	21805	17136
4	Cost B_2	28805	24136
5	Cost C_1	26245	21252
6	Cost C_2	33245	28252
7	Cost C_3	36570	31077
Income measures			
8	Yield		
a	Seed / Grain	60800	47600
c	By-product	2400	2000
9	Gross income	63200	49600
10	Net income	26630	18523
11	Family labour income	34395	25464
12	Farm business income	41895	32964
13	Farm investment income	37455	28848

14	Benefit cost ratio	1.73	1.60
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Discriminant analysis

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 groundnut 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 human labour with 45.56% followed by gross return (35.83%), seed (17.50%), manures and fertilizers (0.69%), bullock and machine labour (0.42%) contributed to discriminate between the seed and grain production of groundnut. It can be inferred that seed, human labour and gross returns were the major contributing factors to discriminate between the two groups of production. This indicates that there were significant differences in gross return between seed and grain production of groundnut.

Table 3: Discriminant variables in groundnut production

Items	Mean (000 Rs.)		Mean difference (d_i)	Discriminant coefficient (L_i)	$L_i \cdot d_i$	Per cent contribution to the total distance
	Seed production	Grain production				
Seed (X_1)	3.640	3.115	0.525	0.239	0.126	17.50
Manures and Fertilizers (X_2)	2.800	3.050	-0.250	-0.019	0.005	0.69
Human labour (X_3)	9.000	5.880	3.120	0.105	0.328	45.56
Bullock and Machine labour (X_4)	8.800	8.300	0.500	0.005	0.003	0.42
Gross return (X_5)	63.200	49.600	13.600	0.019	0.258	35.83
$D^2 = 0.72^{***}$ $Z = 2.648$ $Z_1 = 3.007$ $Z_2 = 2.289$ $F \text{ statistics} = 50.51$ *** indicates significance at 1% level of probability						

CONCLUSIONS AND IMPLICATIONS

The analysis showed that the total cost of cultivation in groundnut seed production was around 18% higher than grain production. Further, the gross return was about 27% higher in seed production than grain production and net return from seed production of groundnut was 44% higher than grain production. The discriminant analysis indicated that human labour with 45.56% followed by gross return (35.83%), seed (17.50%), manures and fertilizers (0.69%), bullock and machine labour (0.42%) contributed to discriminate between the seed and grain production of groundnut. The net return from groundnut 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 groundnut.

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