

Original Research Article

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

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

34

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

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

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

60

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 Cost A_1 = All the variable costs excluding family labour cost and including interest on working capital

81 Cost A_2 = Cost A_1 + Rent paid for leased in land

82 Cost B_1 = Cost A_1 + Interest on value of owned fixed capital (other than land)

83 Cost B_2 = Cost B_1 + Rental value of owned land + Rent paid for leased in land

84 Cost C_1 = Cost B_1 + Imputed value of family labour

85 Cost C_2 = Cost B_2 + Imputed value of family labour

86 Cost C_3 = Cost C_2 + 10% of cost C_2 to account for the value of management input of the farmers

87 Income measures

88 Net income = Gross income - Cost C_3

89 Family labour income = Gross income - Cost B_2

90 Farm business income = Gross income – Cost A_1

91 Farm investment income = Farm business income – 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.

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

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

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

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. 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%). 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 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.

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 (22.56)	7500 (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

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)	$L_i^*d_i$	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.

REFERENCES

- Anonymous. DSR- Perspective Plan Vision 2025. ICAR- Directorate of Seed Research, Kushmaur, Mau, UP, India; 2007.
- Anonymous. Fully Revised Estimates of Principal Crops in Karnataka for the Year 2009-10. Directorate of Economics and Statistics, Bangalore; 2011.
- Anonymous. *Agricultural Statistics at a glance 2013*. Department of Agriculture and Cooperation, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India; 2013.
- Basu MS and Singh NB. *Groundnut Research in India*. National Research Centre for Groundnut, Junagarh; 2004.
- Dillion WR and Goldstein M. *Multivariate analysis: Methods and Applications*. Wiley Publications, New York; 1984.
- Dudhat B, Khunt KA and Rathod PJ. *An Economic Analysis of Groundnut Seed Production in Gujarat State*. Lambert Academic Publishing; 2013.
- Girei AA, Dauna Y and Dire B. An economic analysis of groundnut (*Arachis hypogaea*) production in Hong local Government area of Adamawa State, Nigeria. *Journal of Agricultural and Crop Research*. 2013; 1 (6): 84-89.
- Govindaraj G and Mishra AP. A case of Groundnut crops in India. *Agricultural Economics Research Review*. 2011; 24 (Conference Number): 423-428.
- Kayarkanni S. Profitability of Groundnut production in Kulathur village of Thoothukudi District. *International Journal of Trade and Global Business Perspectives*. 2014; 3 (1): 717-721.
- Khorne GW, Ulemale DH and Tale SG. Economics of groundnut production in Amravati. *International Research Journal of Agricultural Economics and Statistics*. 2014; 5 (2): 201-204.
- Mukhtar AA. Performance of three groundnut (*Arachis hypogaea* L.) varieties as affected by basin size and plant population at Kadawa. Ph.D. Dissertation Submitted to post graduate school, Ahmadu Bello University, Zaria. 2009.
- Mundinamani SM, Hiremath KC and Basavaraja H. An Economic Analysis of Production and Marketing of Groundnut - A Case Study. *Karnataka Journal of Agricultural Sciences*. 1989; 2 (1-2): 89-96.

237 Narayanamoorthy A. Profitability in Crops Cultivation in India: Some Evidence from Cost of Cultivation
 238 Survey Data. Indian Journal of Agricultural Economics. 2013; 68 (1):104-121.

239 Reddy RJ and Shenoy S. The knowledge, adoption and the economic analysis of groundnut
 240 cultivation practices in Mahabubnagar district. International Journal of Scientific and
 241 Research Publications. 2013; 3(7):1-2.

242 Singh G, Asokan SR and Asopa VN. Seed industry in India- A management perspective. Oxford &
 243 IBH Publishing Co. (Pvt.) Ltd., New Delhi; 1990.

244 Usman I, Taiwo AB, Haratu D and Abubakar MA. Socio-economic factors affecting Groundnut
 245 production in Sabongari Local Government of Kaduna State, Nigeria. International
 246 Journal of Food and Agricultural Economics. 2013; 1 (1): 41-48.

247