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Research Article

TECHNICAL EFFICIENCY ANALYSIS OF GROUNDNUT PRODUCTION IN SAURASHTRA REGION OF GUJARAT

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Abstract- Groundnut, the 'king' of oilseeds, is one of the most important food and cash crop in India and around the globe. The state of Gujarat alone caters to nearly 40 per cent of the nation's production. Accordingly, the present investigation concerning technical efficiency of groundnut farmers is aptly undertaken in the Saurashtra region of Gujarat. Findings revealed that technical efficiencies range from 85.90 per cent to 95.34 per cent, with a mean of 85.45 per cent, indicating that on an average the realized yield among farmers can be increased by 15 per cent in the region with the available technology and resources alone, without the use of any additional resources. Interestingly, the average technical efficiency of marginal farmer (95.34 %) was found to be better than that of large farmers (93.68%). Besides, it was also found that the coefficients of groundnut acreage (0.0288) and farmer's age (0.0027) are the most influential determinants of technical efficiency, whereas that of experience (-0.0018) and education (-0.0054) influence negatively. As, the estimates of input utilization pattern have revealed the possibility of improving profits through resource reallocation, the development interventions need to be fine-tuned on improving farm efficiency levels which in turn could lead to improved farm profits.

Keywords-Stochastic frontier analysis, Maximum likelihood estimates, Determinants.

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Introduction

India happens to be the largest producer of all major oilseeds in the world and it is no coincidence that the oilseed sector is the lynchpin of the country's agricultural economy. Nine major oilseeds *viz.* groundnut, rapeseed-mustard, sunflower, safflower, sesame, soybean, castor, niger and linseed together accounted for an area of 28.05 million hectares with the production of 32.75 million tonnes in which groundnut crop alone accounted for 6.87 million hectares and 12.32 million tonnes of production as of 2013-14 [13]. Groundnut crop (*Arachis hypogea* Linn.) got introduced in India in the first half of the 16th century [15].

Despite being an alien crop, India now ranks first in the world in its acreage and second in terms of production next only to China [5]. In terms of yield levels, while the national average was 1765 kg /ha in 2013-14, the best forming states were Tamil Nadu (2721 kg/ha), Gujarat (2668 kg/ha), and Rajasthan (1950 kg/ha) and the poor performing states, below the national average, were Karnataka (863 kg/ha) and Andhra Pradesh (749 kg/ha) [3]. The average yield level in India is better than the world average of 1648 kg/ha, but still it is much lower than the world's highest productivity levels as that of USA (3380 kg/ha); Egypt (3252 kg / ha) and China (3152 kg/ha) [3, 4]. In addition, the inter-regional differences i.e. the difference between high and low yielding states are also significant. One important reason for lower productivity is that many farmers lack access to information and due to inadequate physical infrastructure, unscientific farming, difficulties in understanding and adoption of new technologies, they fail to exploit fully the potential of a technology and end up in making allocative errors while using agricultural inputs and other resources [2, 6, 9, 20, 28, 29, 31, 33, 34].

Thus, increasing efficiency in production assumes greater significance in attaining potential output at farm levels. Now, with the changes realized in the macroeconomic policies of India and due to liberalization of trade policy in the world, competitiveness and resource optimization have to be given more importance in agriculture. Henceforth, it is important to emphasize on efficient use of scarce resources, which have alternative uses. Under these circumstances, reducing the inefficiency is the best option to enhance productivity. Thus, technical efficiency in production of a crop assumes paramount importance. Under this background, the present study has analyzed the technical efficiency of groundnut production in the Saurashtra region of Gujarat state along with the determinants of farm-wise technical efficiency levels.

Materials and Methods

Groundnut is intensively grown in the Gujarat, in which Saurashtra region alone accounts for about 80 per cent of total area under the crop and also contributes near about 80 per cent of its total production in the state. Besides, it ranks first among the oilseed crops of Saurashtra region of Gujarat state. Therefore, the region was purposively selected for the study. For sample selection, multistage random sampling technique was adopted. As groundnut is widely cultivated in almost all the districts of Saurashtra region, two districts namely Jamnagar and Junagadh were selected randomly for the study. Considering the limitation of time and resources, it was decided to randomly select two talukas from each of the selected districts. Accordingly, Jamjodhpur and Kalavad talukas from Jamnagar districts and Mendarda and Keshod talukas from Junagadh district were chosen on the basis of acreage under groundnut cultivation. A village list was prepared with the help of village development officers and three villages were randomly selected from each of the talukas. Thus, a total of twelve villages were selected

The next stage of planning was to select farmers for the detailed analysis. For this purpose, 'Talatis' (the secretary of village panchayats) of every selected village were contacted and a list of the farmers cultivating groundnut in each selected village was prepared. For the purpose of framing the size groups, farmers from each of the lists were arranged in an ascending order on the basis of the size of their land holdings. The list was subsequently stratified into four size groups *viz.*, Marginal (upto 1 ha), Small (1-2 ha), Medium (2-4 ha) and Large (4 ha and above). Subsequently, a sample of 20 farmers was selected at random from each of the selected villages ensuring equal proportion of the four strata. Thus, in all 240 cultivators were selected from twelve villages. The primary data for the study were collected through personal interview method with help of pre-tested comprehensive interview schedule for the year 2014-15. Subsequently, a sample of 20 farmers was selected at random from each of the selected villages ensuring equal proportion of the four strata. Thus, in all 240 cultivators were selected from twelve villages. A pre-tested comprehensive interview schedule was used to collect primary data. The study was carried out in the year 2014-15.

Tools of Analysis

Various studies have employed stochastic frontier production function approach to measure technical efficiency of all major crops [2, 6, 8, 9, 11, 12, 14, 16, 18, 19, 21-25, 28, 30, 32, 34] including groundnut production [8, 26, 27]. Technical efficiency is about the maximum possible output obtained from a given bundle of inputs (including technology) and not just the average output [1, 7, 17, 20]. The advantage of the stochastic frontier production function lies in the fact that its disturbance term can be decomposed into two components, *viz.* (i) symmetric component capturing the randomness outside the control of the farmer (such as drought, floods, *etc.)* which happens to be the statistical noise contained in every empirical relationship (V_i); and (ii) the one-sided error component capturing randomness under the control of the farmer (i.e., inefficiency) (U_i). Thereby, the model has the advantage over others as it comprises a disturbance term representing noise or measurement error or exogenous shocks that are not under the control or management of farmers, in addition to the efficiency component that is under farmers' control. This avoids the overestimation of inefficiency.

Stochastic Frontier Production Function

For the present study, the stochastic frontier production function of the Cobb-Douglas type was specified [9, 12, 19] as given below,

$$\ln Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + \beta_9 \ln X_9 + (V_i - U_i)$$

Where, the subscript 'i' denotes the i^{th} farmer in the sample; 'ln' is the natural logarithm (i.e. to base e); 'Y_i' is the output of groundnut per farmer 'i' (q/ha); 'β_0 to β_9' are parameters to be estimated; 'X_1' is the quantity of seed (kg/ha); 'X_2' is the human labour (human days/ha); 'X_3' is the irrigation cost (Rs/ha); 'X_4' is the quantity of nitrogen (kg/ha); 'X_5' is the quantity of phosphorus (kg/ha); 'X_6' is the quantity of potash (kg/ha); 'X_7' is the quantity of sulphur (kg/ha); 'X_8' is the quantity of manure (tonnes/ha); 'X_9' is the plant protection cost (Rs./ha); 'V_i' is the symmetric (two-sided) error component; and 'U_i' is the one-sided error component (technical inefficiency) The model was estimated with the help of computer programme, FRONTIER 4.1 [10].

Table-1 *Socio-economic characteristics of the sample farm households (n= 240)*

Sl. No.	Variable	Mean	SD
1.	Age (years)	53.26	13.78
2.	Education (years)	8.56	4.11
3.	Family size (Nos.)	5.65	1.49
4.	Farm Experience (years)	31.83	18.78
5.	Average Farm Income (Rs./ Annum)	163204.16	98204.40
6.	Average Off-farm Income (Rs./ Annum)	34650	14774.96
7.	Average Non-farm Income (Rs./ Annum)	98704.16	86804.22
8.	Average Area (ha)	2.67	1.85
9.	Average Area under groundnut crop (ha)	1.38	0.68

Source: Field Survey. Note: 'SD' refers to Standard Deviation

Determinants of Technical Efficiency

Several studies have shown a positive relationship between technical efficiency and socio-economic characteristics of farmers [8, 9, 17, 24, 27]. In order to find out the contribution made by each factor, the level of technical efficiency of the farmers under consideration was regressed on these factors. A simple linear multiple regression equation was estimated using Ordinary Least Square (OLS) technique given below,

$$TE_i = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + e_i$$

Where, TE_i is the technical efficiency of the 'i^{th}' farm; 'X_1' is the area under groundnut crop (in ha); 'X_2' is the experience in groundnut cultivation (in years); 'X_3' is the age of the groundnut growing farmer (in years); 'X_4' is the education level of the farmer (in years); 'X_5' is the number of working members in the family; 'X_6' is the land Fragmentation Index (LFI = No. of fragments / Total area under groundnut); 'X_7' is the proximity of the farm household to the market yard for the purchase of farm inputs (in km); 'b_0' is the Intercept term; '$b_1 ... b_7$' are the Coefficients of respective factors influencing the technical efficiency; 'e_i' is the random error term. The market proximity was assumed to improve farm technical efficiency as the nearness to market would enable farmers to apply inputs at requisite intervals.

Results and Discussion

General Characteristics of the sample farm households

The socio-economic characteristics of the sample farm households are given in [Table-1]. It could be found that, on an average the head of the farm household was of 53 years of age with nearly 32 years of farm experience. The family size consisted of 5.6 members with an average education of 8.6 years. On an average, the farm income and off-farm income put together (Rs. 1, 97, 854) exceeded that of non-farm income (Rs. 98,704). This could only mean that agriculture continues to be the major source of sustenance in the study area. Further, out of the average total area (2.67 ha), roughly 52 per cent (1.38 ha) was found to be under groundnut cultivation. All the sample farmers were found to have their groundnut crop acreage under irrigation.

Estimation of Frontier Production Function

Stochastic production function approach has been used to estimate technical efficiency of groundnut production in the study area. Maximum Likelihood Estimates (MLE) were used to estimate the parameters of frontier production function and the results are presented in the [Table-2]. Findings showed a high value of γ (0.9205) for all sample farms, which represents the presence of significant inefficiencies among farmers in groundnut production. Thereby, it can be inferred that 92 per cent of the differences between the observed and maximum production frontier outputs were due to the factors that are under the control of farmers in the study area. In other words, 92 per cent of observed inefficiency in production was due to farmers' inefficiency in decision-making and only 8 per cent of it was due to random factors outside the control of all the sample farmers. These findings are in conformity with the findings of [7, 11, 14, 21, 25]. Similarly, the values of γ were 55 per cent, 99 per cent, 99 per cent and 69 per cent in case of marginal, small, medium and large size farms, respectively. Thus, the one sided-error u_i dominated the symmetric error v_i and the short fall of realized productivity from the frontier was largely due to technical inefficiency and was within the control of farmers.

Further, the estimates of stochastic frontier production function have shown that in the case of all the sample farmers, the estimated values of the coefficients of human labour (0.408), irrigation cost (0.033) and quantity of sulphur fertilizer applied (0.023) were positive and highly significant, indicating that they are productive inputs for successive production of groundnut crop. At the same time, the negative but significant coefficient of seed (-0.133) indicated the over-use of the resource. The coefficient estimates of other inputs like that of nitrogen, potash and manure were positive but non-significant implying that though the contribution in terms of output was positive, the effect was not real.

Table-2 *Farmer-wise maximum likelihood estimates of stochastic frontier production function in the study area*

Variables	Marginal farmer		Small farmer		Medium farmer		Large farmer		All farmers	
	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE
Constant	2.439**	0.626	1.030**	0.263	1.126**	0.103	3.461**	0.796	2.024**	0.573
Seed	-0.247**	0.077	-0.110	0.068	0.017	0.099	0.0003	0.0564	-0.133*	0.065
Labour	0.279**	0.093	0.025	0.047	0.238*	0.111	0.076	0.117	0.408**	0.080
Irrigation	0.016**	0.002	0.025**	0.002	-0.023	0.048	-0.067	0.055	0.033**	0.002
Nitrogen	-0.049	0.039	0.077	0.043	0.038	0.060	-0.038	0.077	0.024	0.053
Phosphorus	0.024	0.061	0.097**	0.029	0.177	0.092	-0.036	0.050	-0.060	0.043
Potash	-0.003	0.003	-0.007	0.004	-0.007	0.004	0.0006	0.0045	0.004	0.003
Sulphur	0.003	0.003	0.005**	0.000	0.015*	0.007	0.029**	0.010	0.023**	0.003
Manure	-0.001	0.001	-0.010**	0.000	-0.000	0.001	0.0003	0.0018	0.0003	0.001
PPC	0.011	0.037	0.172**	0.029	0.004	0.071	-0.021	0.048	-0.038	0.031
σ^2	0.006*	0.002	0.039**	0.005	0.023**	0.003	0.010*	0.004	0.045**	0.006
Gamma (γ)	0.550	0.371	0.999**	0.000	0.999**	0.000	0.693*	0.322	0.920**	0.042
LL	78.094		53.812		64.853		70.492		14.884	

Note: 1. Coeffi. is the coefficient and SE is the Standard Error of the factors in question.
2. * and ** denotes significance at 5 per cent and 1 per cent levels, respectively.
3. PPC – Plant Protection Cost; LL – Log Likelihood.

Farm-wise Maximum Likelihood Estimates

Marginal Farmers

For marginal farmers, the coefficients of human labour (0.279) and irrigation cost (0.016) were found to be positive and highly significant [Table-2]. The positive sign of human labour implies that as the usage of human labour increases, the output of groundnut also increases. The significance of human labour could be understood from the fact that groundnut production is labour intensive right from weeding to harvesting. Hence, for realizing optimum yields, increase in the deployment of human labour is required. On the other hand, in the case of irrigation in groundnut crop, there is a need for it to be given at critical stages i.e. from pegging to pod formation. As per the recommendations of TNAU [35] failure of irrigation during the critical stages of groundnut crop increases the chances of yield loss to more than 50 per cent. Hence, there is a great scope for increasing yield by spacing out irrigation intervals at the critical stages. The coefficient of seed (-0.247) was negative and highly significant indicating the over-use of the input among marginal farmers. The reason behind over use of seed may be due to poor germination, insufficient moisture content in the soil after sowing, failure of plantation as a consequence of stem rot and root rot diseases and seed damage while using automatic seed drill.

Small Farmers

In the case of small farmers, the estimated coefficient values of irrigation cost (0.025), phosphours (0.097), sulphur (0.005) and plant protection cost (0.172) were found to be positive and highly significant. This shows that the small farmers can increase per hectare yield by applying more units of these inputs. Besides, when compared to other positive and significant inputs, the elasticity coefficient was highest for plant protection chemicals. For every one per cent increase in plant protection cost, the net output is found to be increased by 0.172 per cent while other variables are kept constant. This may be due to the fact that the use of plant protection chemicals reduces the drudgery in farm operations such as weeding and rouging as well as may increase the quantity of output indirectly by controlling the incidence of pests and diseases. The coefficient of manure was negative (-0.01) and highly significant, indicating the over-use of manure in groundnut production among small farmers. Generally, the use of manure has positive impact on crop yield. But, the negative sign of coefficient of manure in this study shows that the excess use of manure would have lead to the increased infestation of white grub and termites which in turn might have affected the crop output. Other variables like, human labour and nitrogen were positive but statistically non-significant indicating human labour and nitrogen components in small farms contributed positively to the output, though the effect was not real.

Medium Farmers

Across the medium farmers, the estimated value of the coefficients of human labour (0.238) and sulphur (0.015) were significant at 5 per cent and were positively related to groundnut production. This indicated that the medium farmers can increase per hectare yield by applying more units of these inputs. The negative sign was observed in case of the coefficient of the irrigation, potash and manure which implied that these inputs were not directly related to the crop output, while the non-significance of the coefficients indicated that these were not a determinant of output in groundnut production either.

Table-3 *Distribution of sample farmers under different levels of technical efficiency*

Technical efficiency (%)	Number of farms	% to total
61 - 65	2	0.83
66 – 70	3	1.25
71 – 75	10	4.17
76 – 80	13	5.42
81 – 85	23	9.58
86 – 90	23	9.58
91 – 95	65	27.08
More than 95	101	42.09
Total farms	240	100.00
Mean efficiency (%)	85.45	

Large Farmers

The coefficient of sulphur fertilizer (0.029) alone was found to be positive and highly significant among large farms indicating that increased yield levels can be obtained in these farms by applying more units of this input. As per the recommendations of Junagadh Agricultural University, Junagadh, application of sulphur in the soils- containing less than 20 mg of sulphur per kilogram of soil, increases the groundnut crop yield significantly. On the other hand, the estimated elasticity coefficients of all other inputs *viz.* seed, human labour, irrigation, nitrogen, phosphorus, potash, manure and plant protection chemicals were found to be non-significant indicating very less scope in increasing the use of these factors in groundnut production crop among large farmers. The negative and non-significant values of elasticities of irrigation, nitrogen, phosphorus and plant protection chemicals may in turn be due to their over utilization.

Technical Efficiency Levels of All Sample Farmers

The details regarding farm-specific technical efficiencies are important as they provide valid information to policy makers on the nature of production technology used in farms. [Table-3] shows the frequency distribution of sample farms by the level of technical efficiency in raising groundnut crop. It was observed that there were wide variations in technical efficiencies across the sample groundnut farmers. The mean technical efficiency of all farmers was 85.45 per cent, implying that on an average, the sample farmers tend to realize around 85 per cent of the technical potential in terms of groundnut yield. Hence, on an average, approximately 15 per cent of technical yield potential was not realized. Therefore, it may be possible to improve the yield of groundnut crop by 15 per cent in the study area by following efficient crop management practices alone without increasing the level of inputs application. These results were in line with those of [16, 22, 32].

Besides, it was also observed that a majority of the farmers (51.66 %) operated at technical efficiency levels between 76 per cent and 95 per cent. At the same time, only about 6.25 per cent of the groundnut farmers were found below 76 per cent of the technical efficiency level. Further, the analysis revealed that about 42.09 per cent of the sample farmers were operating closer to frontier with the technical efficiency of more than 95 per cent. Thereby, as a whole, a majority the sample groundnut farmers were found to be with lesser technical inefficiencies which could be mainly attributed to their sound capital base, use of modern technology in cultivation, and efficient use of some of the resources. In addition, a farmer-wise classification of technical efficiency is also presented in the subsequent discussions.

Technical Efficiency by Farm Size Groups

The frequency distribution of estimated technical efficiency for the sample households by farmer-size groups, given in [Table-4], reveals that the mean technical efficiency ranged from 85.90 per cent (small farmers) to 95.34 per cent (marginal farmers). Further, findings also show that around 30 per cent, 25 per cent, 35 per cent and 57 per cent of marginal, small, medium and large farmers respectively were found to be at efficiency levels between 86 and 95 per cent. It could be seen from the table that around 27 per cent of small farmers operated at the efficiency levels between 71 and 80 per cent, while 30 per cent of medium farmers were found to be at efficiency level of less than 86 per cent. The results also revealed that 50 per cent of large farmers operated at the efficiency level between 91 and 95 per cent.

Table-4 *Frequency distribution of farm-specific technical efficiencies*

Technical efficiency (%)	Frequency of sample groundnut farms							
	Marginal	% to total	Small	% to total	Medium	% to total	Large	% to total
61 - 65	0	0.00	1	1.67	1	1.67	0	0.00
66 – 70	0	0.00	1	1.67	2	3.33	0	0.00
71 – 75	0	0.00	6	10.00	4	6.67	0	0.00
76 – 80	0	0.00	10	16.67	3	5.00	0	0.00
81 – 85	0	0.00	13	21.67	8	13.33	2	3.33
86 – 90	1	1.67	6	10.00	12	20.00	4	6.67
91 - 95	17	28.33	9	15.00	9	15.00	30	50.00
More than 95	42	70.00	14	23.32	21	35.00	24	40.00
Total farms	60	100.00	60	100.00	60	100.00	60	100.00
Mean efficiency (%)	95.34		85.90		88.93		93.68	

Marginal farm-size groups were found to be most efficient in groundnut farming as they were operating much closer to the frontier with mean technical efficiency of 95.34 per cent even when compared to large farmers (93.68%). This implies that on an average, marginal farmers are more efficient than small, medium and large farmers, negating thereby the myth that large size farming is more profit/business oriented. The findings of [30] showing that small farm size had more technical efficient than medium and large farm size are in line with the present findings. The relatively higher technical efficiency of marginal size farms may be attributed to their motivated family labour, whereas other farms were dominated by hired labourers. In addition, many of the marginal farmers showed agriculture as their main occupation, unlike the other farmer categories where farming was demoted as secondary income source, thereby, allocation of resources might have been more effective, leading to higher technical efficiency. At the same time, the technical efficiency of large farmers (93.68%) was second best since they were in a relatively good financial position to apply right dose of inputs at right intervals.

Determinants of Technical Efficiency

Area under Groundnut Crop

Among the socio-economic attributes that may impact technical efficiency, the coefficients of groundnut acreage (0.028) was found to be positive and significant [Table-5] indicating that farmers with large operational area were more efficient in producing groundnut. The present finding is in line with the findings of [18, 23, 26]. This could be so because large farm size motivates the adoption of innovative practices, which can translate into higher output.

Moreover, medium and large farmers can efficiently utilize inputs and machinery due to their large-size. At the same time, it was seen that the technical efficiency of marginal farmers was higher when compared to medium and large farmers [Table-4]. The reason for higher technical efficiency of marginal farmers may be due to the fact that they have more numbers of family labour, which dominated the hired component of labour on their farms. Besides, as agriculture was the prime occupation of marginal farmers they were sincere and more effective in allocation of resources leading to higher technical efficiency. Also it has to be noted that the coefficient of human labour (0.27) in marginal farmers was positive and highly significant [Table-2] and was more than the coefficient of area under groundnut (0.02) [Table-5]. Thereby, considering all the reasons discussed, the effect of area on technical efficiency was negligible in case of marginal farmers and it benefited only due to sound and dedicated family labour, which was not the case of other farmers.

Table-5 *Factors influencing technical efficiency of groundnut production in the study area*

Variable	Coefficients	Standard error
Intercept	0.7947**	0.0751
Area under groundnut	0.0288**	0.0104
Experience	-0.0018*	0.0009
Age	0.0027*	0.0012
Education	-0.0054*	0.0027
No. of family labourers	0.0050	0.0038
LFI	-0.0151	0.0173
Market Proximity	-0.0010	0.0006
R^2	0.4913	

Note: * and ** denotes significance at 5 per cent and 1 per cent levels, respectively; LFI - Land Fragmentation Index.

Experience in Groundnut Farming

The negative and statistically significant value of coefficient of farmer's experience (-0.0018) in groundnut cultivation indicated that the technical efficiency of farmers decreases with increase in farming experience. Thereby, experience of the farmers proves to be its deterrent instead of acting as a determinant of technical efficiency. The reason for negative relationship between technical efficiency of farmers and their experience in groundnut farming may be due to the fact that the new technologies might have been taken for granted by the experienced farmers resulting in their non-participation in various extension and other field demonstration programmes. On the contrary, young and less experienced farmers in groundnut cultivation would be very eager to know about new technologies and their participation would be more in extension programmes.

Age of the Farmer

At the same time, it is interesting to note that the coefficient of farmers' age was found to be positively significant (0.0027). With that, the age component turned out to be one of the key determinants of technical efficiency. This may be due to the fact that the old age farmers would be in a better position when it comes to decision making as they would be able to gauge the importance of any improved technique or technology by their experience which in turn may improve technical efficiency. As they get older farmers also play advisory role in guiding other farmers to adopt a technology. In general, experience is directly proportional to age i.e. more the age of a farmer more will be the experience. But by all means, the age component itself cannot be translated into experience as-such, that too, on a specific cropping activity like groundnut cultivation.

For instance, a farmer with 50 years of age may have only 5 years of experience in groundnut cultivation when compared to a 35 year old farmer with 10 years of experience on the same crop. This may be due to the fact that the year of engagement i.e. the year in which the specific cropping activity was taken by the farmer, usually varies among the sample farmers. That is why, when experience in groundnut farming was found to be negatively influencing technical efficiency, the age component of the farmer, on the other hand, was found to be positive and significant upon technical efficiency at the same time.

Education of the Farmer

Moreover, the value of the estimated coefficient of farmer's education (-0.0053) was negative and significant at 5 per cent level. It indicates that the technical efficiency of farmers decreased with increase in education level. The education levels of farmers are known to have positive effect on their farming activities, in general. Though, agricultural extension and other policy experts often point out that farmers with higher education qualification seem to adopt agricultural technological innovations more than those without or with lower educational qualification, the findings of the present study stand contrary to the claim. It may be due to the fact that the educated farmers in the study area were found to be concentrating more on business activities rather than on farming and also were found doing farming operation on contract basis. This might have contributed to the fall in technical efficiency with the increase in education. The coefficient of family labour has shown a positive relationship with technical efficiency. However, the variable was not statistically significant. The coefficients of land fragmentations index and proximity to market yard for the purchase of inputs though negative were non-significant.

Conclusion and Way Forward

The study has revealed that the variation in the groundnut crop output across the sample farms is due to difference in the technical efficiency levels of farmers. The mean technical efficiency was found to be at 85 per cent among the sample farms, indicating that, on an average, the realized output of farmers can be increased by 15 per cent as a whole without any additional resources in the region. Thereby, proper management and proper allocation of existing resources and technology can lead to significant improvement in groundnut productivity levels. Besides, provision of timely and adequate quantity of improved seeds, fertilizer, low-cost technologies coupled with farm mechanization strategies and real-time technical advisory may help in improving the level of technical efficiency of groundnut farmers. Besides, as the availability of credit, leading to timely and adequate application of inputs, decides the input-use efficiency to a large extent, thereby, facilitating real-time credit availability, adjusted to inflation levels, during all the stages of the groundnut crop would improve farm efficiency and in turn farm profits.

Conflict of Interest: None declared

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