AN EFFICIENCY ANALYSIS OF STATICE CUT-FLOWER: A CASE STUDY OF DISTRICT KASUR, PAKISTAN

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ABSTRACT: Farmers in developing countries like Pakistan do not make the best use of all potential resources; therefore, they make inefficient decisions in their agricultural activities. Primarily this study aims at estimating efficiency in Statice (cut-flower) production and also investigating some socioeconomic factors responsible for inefficiency. A survey with a sample of 70 farmers engaged in the cultivation of Statice cut flower was conducted during the year 2012 in district Kasur of Punjab province, Pakistan. Purposing sampling technique was employed for the selectrion of the respondents. The non-parametric Data Envelopment Analysis (DEA) and Tobit regression model was used for data analysis. The mean technical, allocative and economic efficiency of the sampled farmers were calculated as 0.86, 0.67 and 0.57 percent, respectively. Results of Tobit Regression model indicated that the variable, years of schooling as well as irrigation source (canal water), have a negative and significant impact on technical, allocative and economic inefficiency of Statice cut flower. It was also found that farmer's flowers growing experience and area under cut-flowers also negatively and significantly affected inefficiency. It is recommended that government should motivate the educated and experienced farmers in this venture and the availability of sufficient canal water should be ensured to the farmers, cultivating Statice cut flower.

Keyword: DEA, Efficiency, Kasur, Pakistan, Statice Cut-Flower, Tobit Regression.

(Received 28-10-2015 Accepted 16-06-2016)

INTRODUCTION

Floriculture is a fast emerging and highly competitive industry in an agrarian culture. It has emerged as a lucrative profession with the much higher potential for returns compared to other horticultural crops. Ornamental crop culture technology is improving with the availability of equipment and there is also a sea change in the trend of consumers. A new generation of growers is coming forward to employ modern technology for maximizing production and offer quality products for consumer acceptability, thus fetching a better price (Sudhagar, 2013).

Flowers are crowning beauty of God’s creation. They are an inseparable part of human joy and sorrows. It is said that man is born with flowers, lives with flowers and finally dies with flowers. Statice flowers are popularly used in dried flower arrangements, bouquets and other ornamental purposes. The flower-farming is a labor-intensive business. It requires a large number of labor from production till sale in the market. Pakistan has abundant labor, living in both urban and rural areas. Investment in this sector is apparent from the augmented number of greenhouses, nurseries, flower shops, flower auction centers and the production of cut-flowers (Usman *et al.,* 2013).

About 306 thousand ha area is under flower cultivation in different countries of the world, of which the total area in Europe is 44,444 ha, North America 22,388 ha, Asia and Pacific 2,15386 ha, the Middle East and Africa 2,282 ha and central and South Africa 17,605 ha (Sudhagar, 2013). In Pakistan about 6 percent of arable land is under horticultural crops, out of which only 0.5 percent is under floriculture. The total local production of cut-flowers is estimated to be 10000-12000 tons per annum (Usman *et al.*, 2014).

About 90 % of the farmers in Pakistan are small holders. Floriculture is the best option for enhancing the income of small farmers in Pakistan. The diverse agro-climatic conditions in Pakistan suit all kinds of floriculture crops, including cut flowers, and potted plants throughout the seasons (Usman *et al.*, 2013). District Kasur of Punjab province is the main cut flower cultivating region in Pakistan. Pattoki cut-flower market is the largest cut-flower auction market in the country (Usman and Ashfaq, 2013). The floriculture crops fetch high prices practically around the year due to their high demand in the world. There is no need to wait for prices in cut-flower cultivation as in the case of other traditional crops wheat, sugarcane and cotton etc. The net earnings are higher in contrast to various other traditional crops (Usman, 2013).

Floriculture in Pakistan is at its embryonic stage. Constraints in the development of floriculture business include the of low quality seed, substandard and low financial opportunities by exclusive authorities, Deficit of standardization is connected with packing and post-harvest losses, deficit of accessibility to high class elite vegetation stuff, infrastructural amenities, lack of handling and cool chain facilities. There is a need of skilled people and resources for growing floriculture crops up to worldwide standards. It is the need of the hour to produce qualified persons to make sure subsistence to farmers and promote insurance policies to safeguard floriculture farmers (Ashfaq *et al.*, 2015).

Although there is a great potential for export of flowers, but Pakistan is still far behind in competition at international level with regards to quality and other international standards. The research and development in floriculture sector is also very little and the data on production, marketing and other aspects of floriculture is very scanty. Previously, no study was conducted to estimate efficiency of statice cultivation in Pakistan. In this study technical, allocative and economic efficiency of farmers is estimated. Impacts of socioeconomic and other farm specific factors on technical, allocative and economic inefficiency of farms were also investigated.

MATERIAL AND METHODS

Sampling Procedure and Data: Primary data of 70 farmers, thirty five respondents from each of two regions, i.e. Pattoki and Chunian of district Kasur was collected in 2012 through a ‘‘Purposive Sampling Technique’’. A well-considered and already tested questionnaire was utilized to get relevant data regarding various specific variables at the farm. Analysis was carried out by Data Envelopment Analysis (DEA) by using the Data Envelopment Analysis Program (DEAP) (Coelli *et al.*, 1998).

Efficiency Estimates: The concept of efficiency was first given by Farrell (1957). The efficiency is defined as the real productivity of a firm with respect to its optimal productivity or the production frontier (Lissitsa *et al.*, 2005). Often two approaches were used to estimate the efficiency; first was the parametric approach by using Stochastic Frontier Analysis (SFA) and the second was the non-parametric approach by using Data Envelopment Analysis (DEA). These both techniques quantify the best practice frontier and calculated the efficiency of a firm relative to that frontier (Latruffe, 2002). While the non-parametric models were mathematical programming based. A linear programming technique which uses data on inputs and productions was used to build a best practice production frontier.

Technical Efficiency: Scores for technical efficiency could be gained by applying a constant return to scale in non-parametric model first developed by Charnes *et al.*, (1978). This model was only appropriate when all firms were operating at an optimal scale; this was not possible in agriculture due to many constraints (Coelli *et al.*, 1998). Therefore an input-oriented model under the postulation of variable returns to scale was used to assess technical efficiency in the study.

The output for the estimation of technical efficiency was farm revenue (Y). The total revenue from statice flower was valued by multiplying the output with the price received by the respondents. The input variables considered in the analysis were number of ploughing (X_1), planking (X_2), rotavator (X_3), ridge making (X_4), and amount of labor (X_5), seed (X_6), FYM (X_7), urea (X_8), DAP (X_9), SSP (X_{10}), irrigation (X_{11}) and pickings (X_{12}).

Where as, w_{1i} represented the total cost of ploughing, w_{2i} represented the total cost of planking, w_{3i} represented the total cost of rotavator, w_{4i} represented the total cost of ridges, w_{5i} represented the total cost of labor, w_{6i} was the total cost of seed, w_{7i} was total cost of FYM (Farm Yard Manure), w_{8i} was the total cost of urea, w_{9i} was total cost of DAP (Di Ammonium Phosphate), w_{10i} was total cost of SSP (Single Super Phosphate) and w_{11i} was total cost of irrigation and w_{12i} was the amount paid for pickings in rupees for i^{th} farm.

Economic Efficiency: This is the ratio between the minimum and observed costs and Cost minimization model which was used for minimum cost assessment as has been reported by Coelli *et al.*, (1998). It is calculated as under.

Economic efficiency = Minimum Cost (MC) / Observed Cost (OC)

Allocative Efficiency: It was estimated by taking the ratio between economic and technical efficiencies and in the form of the equation. It could be written as follows.
Allocative efficiency = Economic Efficiency (EE) / Technical Efficiency (TE)

Determinants of Production Inefficiency: Often two approaches are used to investigate the association in farm inefficiency and various socioeconomic variables. The first method is a simple, non-parametric analysis whereas the other one is regression model. The second method is a two-step procedure, commonly used in the studies and the same was used in the present study (Haji, 2006). The method adopted by Ogunyinka and Ajibefun (2004) was used to analyze inefficiency. The technical, allocative and economic inefficiency scores were separately regressed on various socioeconomic and farm explicit factors for finding the sources of inefficiencies. Tobit regression model (1958), as reported by Long (1997) was used. Generalized form of model is as follow,

$E_i^* = Z_i\beta + \mu_i$

$E_i^* = 0 \quad if\ E_i^* \leq 0$

$E_i = E_i^* \quad if\ E_i^* > 0$

Here E_i showed the inefficiency score, β was for unknown factors and Z_i was for socioeconomic as well as farm-specific variables. E_i^* was index or latent variable.

Tobit Regression: In order to find the rational for the efficiency disparities across the farms of the study area Tobit model was used. Factors involved in the analysis were, education (year), respondent age (year), number of family workers, experience of farming or floriculture, irrigation source, seed source, total operational land holding and statice flower acreage of the selected farms. Model used can be written as below.

$$Ei = \beta 0 + \beta 1Z1i + \beta 2Z2i + \beta 3Z3i + \beta 4Z4i + \beta 5Z5i + \beta 6Z6i + \beta 7Z7i + \beta 8Z8i$$

If $E_i^* > 0$

Where, Z_i represented the age (year), Z_{2i} education (year), Z_{3i} family labor (No.), Z_{4i} flower growing experience (years), Z_{5i} was a dummy variable for land ownership (with 1 if yes otherwise 0). Z_{6i} was a dummy variable for canal water, Z_{7i} is a dummy variable for purchase seed and Z_{8i} represents the area under the statice flower of the i^{th} farms' in acres. β's represent the slops and μ_i shows the noise term.

RESULTS AND DISCUSSION

Summary Statistics: The empirical results of the study indicated that average per acre revenue of the sample farms in the study areas was Rs.511751 with standard deviation of 13629, indicating that there existed high variability in per acre revenue among the sample farms. The average cultivator, planking, rotavator and number of ridges of the sample farms were 4.04, 2.40, 0.31 and 67, with a standard deviation of 0.69, 0.62, 0.47 and 4.83, respectively. The average seed quantity used per acre by the sample farms was 109.93 grams. The average FYM (trolleys) applied by the sampled farms was 0.87, with a standard deviation of 1.17. The average urea, DAP and SSP bags used by the sample farms per acre per season was 3.23, 1.29 and 0.71, respectively. The mean irrigations applied per acre per season was 4.83 and the standard deviation was 1.60. Average picking per season was 38.19, with standard a deviation of 6.24.

The results indicated that the cost of average cultivations, planking, rotavators and ridges of the sample farm was Rs.2373, Rs.685, Rs.370 and Rs.663, respectively, with a standard deviation of 452.59, 188, 554.65 and 70.92, respectively showing that there existed high variability in the cost of cultivations, plankings, rotavators and ridges among the sample farmers in the study area. The average labor cost of the sample farms was Rs.11559 with a standard deviation of 2506 and average seed cost was Rs.1935 with a standard deviation of 1773, indicating that there was high variability in the labor and seed cost among the sample farms. The average urea cost of the sample farms was Rs. 3770 with a standard deviation of 1519, DAP cost was Rs.4768 with a standard deviation of 2794 and average SSP cost was Rs.1609. The average irrigation cost of the sample farms was Rs.424 with a standard deviation of 954 and average picking cost was Rs.11884 with a standard deviation of 2581, indicating that there was high variability in the irrigation and picking cost.

In the study area, average age of the sample farmers was 38 years with standard deviation of 12.12 and the average schooling was 9 years with standard deviation of 4.36. The average family worker of the sample farms employed in Statice farming was 3 with a standard deviation of 1. The average flower growing experience of the sample farmers was 13 years with a standard deviation of 7.45 and the average Statice cut-flower acreage in the study area of the sample farms was 1.37 acres with a standard deviation of 0.67.

Efficiency Estimation: The results of the DEA model revealed that mean technical efficiency of the sample farmers in the study area was 0.86 with a minimum of 0.38 (See Table 1). The results of the study revealed that 53 sample statice growers were technically efficient and were operating at technical efficiency level greater than 0.90. Only one sample farmer was operating at technical efficiency score of less than 0.40. The sample farmers that were operating between technical efficiency score of 0.51 and 0.70 was 15 percent. The 23 percent sampled farmers were lying between technical efficiency score of 0.71 and 0.90. If the sample Static farmers worked at the same technical efficiency level, as the majority of the efficient farmers in the sample, they could reduce their average input use by 14 percent and could still produce the same level of output.

The minimum allocative efficiency score of the sample statice farmers was 0.50, and average 0.67. The sampled farmers could reduce their average cost of production by 33 percent with existing technology, and without decreasing the level of output, if they operated at full efficiency level. The majority of the growers were operating between allocative efficiency level of 0.41 and 0.80. The allocative efficiency score of 8.6 percent sampled farmers was between 0.81 and 0.90. The minimum and mean economic efficiencies of the sampled farmers were 0.24, and 0.57, respectively. About 14 farmers were operating between economic efficiency score of 0.71 and 0.90. The economic efficiency score of a majority of the sample famers was lying between 0.21 and 0.71. In the study area only 2.9 percent farmers were operating at an economically efficient level i.e. 1

Table 1. Empirical Results of Estimated Efficiencies

Particular	Technical Efficiency	Allocative Efficiency	Economic Efficiency
Minimum	0.38	0.50	0.24
Maximum	1	1	1
Mean	0.86	0.67	0.57

Source: *Author's Own Calculation*

Sources of Inefficiencies among Sample Farmers: The present study was carried out by employing Tobit Regression Model to investigate the impact of socioeconomic and farm specific factors on the inefficiencies of the sampled farmers in the study area. The results of the Tobit Regression Model indicated that the variable of the farmers' education was negative and significant on technical inefficiency (Table 2). The results, of present study were in accordance with the studies carried out by Abedullah *et el.,* (2007); Javed *et al.,* (2009). They reported that educated farmers used the resources better than their counterparts who were less educated. Hussain *et al.,* (2014) reported that with an increase in the education of the farmers, the technical inefficiency of the farmers' decreases. It was reported that farmers with better education were more efficient in the use of their limited resources than their counterparts who were less educated. Investment in human capital was a powerful tool to increase efficiency of statice cut-flower producing farmers. The government should motivate the educated farmers in the cut-flower growing activity (Usman *et al.,* 2015a,b).

The variable of family farm worker was negative and significantly which affected the technical inefficiency. Larger families with more agricultural workers may facilitate the timely availability of labor and gain knowledge of the technical know-how required for cut-flower production (Islam *et al.,* 2012). Hollaway *et al.,* (2002) also reported similar results indicating that higher subsistence pressure could lead to increasing the adoption of new agricultural technologies that could ensure continuous food access for these household. Nargis and Lee (2013) reported that farmers with a large pool of family labor might be benefited from being able to use these labor resources at the right time, particularly at peak cultivation times.

Canal water irrigation had negative and significant impact on the technical inefficiency scores, indicating that with the increased use of canal water the technical inefficiency scores decreases. Abedullah *et al.,* (2007) reported that development in irrigation amenities could significantly enhance the production area. Khai and Yabe (2011) reported that farmers with tube well irrigation produced more efficiently than those without irrigation (Table-2).

The variable of age showed a negative and significant impact on allocative inefficiency. This variable was in accordance with the study corrected by Javed *et al.,* (2009). It was reported that alloacative inefficiency of the Statice farmers declined with the increase in the age of the farmers. Elder farmers were less allocatively efficient than their counterparts that were younger. It was suggested that the policy makers should develop policies to engage younger farmers in floriculture by offering them incentives and procurement policies.

The variable of schooling, had also negatively and significantly affect on allocative inefficiency. The variable of Statice cut-flower acreage was negative and had significant impact on allocative inefficiency. Tobit Regression Results

of economic inefficiency revealed that the variables of years of schooling, family farm worker, and irrigation source (canal water) and Statice acreage had a negative and significant impact on economic inefficiency (Table 2).

Table 2. Determinants of Inefficiencies among Sampled Statice Farmers.

Variable	Technical Inefficiency		Allocative Inefficiency		Economic Inefficiency	
	Coefficient	**Standard Error**	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**
Constant	0.676	0.100 S	0.558	0.040 S	0.782	0.054 S
Age	-0.002	0.002 NS	-0.001	0.001 S	-0.001	0.001 NS
Education	-0.018	0.005 S	-0.007	0.002 S	-0.011	0.003 S
Family Worker No.	-0.046	0.023 S	-0.013	0.010 NS	-0.027	0.014 S
Flower Growing Experience	-0.005	0.003 NS	0.000	0.001 NS	-0.001	0.002 NS
Dummy for Tenancy	-0.032	0.042 NS	-0.014	0.018 NS	-0.025	0.025 NS
Dummy for Irrigation Source	-0.120	0.047 S	-0.056	0.020 S	-0.085	0.027 S
Statice Area	-0.009	0.028 NS	-0.038	0.010 S	-0.037	0.014 S

Source: *Author's Own Calculation* *S= significant NS= Non-Significant*

Conclusion and Recommendations: This study employed the non-parametric DEA and Tobit Regression Model to estimate efficiencies and the determinants of the inefficiencies of the sampled Statice cut-flower farmers in the study area during 2012. The results of the analysis revealed that the mean technical efficiency of the sampled farmers was 0.68 while allocative and economic efficiencies were calculated as 0.67 and 0.57 percent.

The sampled farmers could reduce their average cost of production by 43 percent with existing technology and without decreasing the level of output, if they had operated at full efficiency level. Results of Tobit Regression analysis revealed that years of schooling and irrigation source (canal water) had a negative relation with technical, allocative and economic inefficiency scores of the sample farms. The most noticeable suggestion of the results of this study is that sound guidelines are desirable to promote formal education among rural households as a mean of improving efficiency in the long run. There should be availability of canal water in the statice growing season. Government should design policies to attract and encourage younger people in farming by providing them incentives. The area under the cut-flower should be increased through the services of the extension agents. There is need of development of proper cut-flower markets, infrastructure and roads near the flower production areas.

REFERENCES

Abedullah., S. Kouser and K. Mushtaq (2007). Analysis of Technical Efficiency of Rice Production in Punjab (Pakistan) Implications for Future Investment Strategies. Pakistan Economic and Social Review 45 (2): 231-244.

Ashfaq, M., M. Usman, Q.M. Din, and S.A. Adil (2015). Economics, Management and Marketing of Cut Flowers: A Case Study of Selected Districts of Punjab, Pakistan. Institute of Agricultural and Resource Economics, University of Agriculture, Faisalabad Pakistan. ISBN: 978-969-8237-71-4.

Charnes, A., W.W Cooper, and E. Rhodes (1978). Measuring the Efficiency of Decision Making Units. European Journal of Operational Research 2: 429-444.

Coelli, T., D.S.P. Rao, and G.E. Battese (1998). An Introduction to Efficiency and Productivity Analysis. Kluwer Academic Publishers, Boston,USA.

Farrell, M (1957). The Measurement of Productivity Efficiency. Journal of the Royal Statistics Society, Series A 120: 253-290.

Haji, J (2006). Production Efficiency of Small Holder’s Vegetable Dominated Mixed Farming System in Eastern Ethiopia: A Non-Parametric Approach. Journal of African Economies 16: 1-27.

Hollaway, G., B. Shankar and S. Rahman (2002). Bayesian Spatial Probit Estimation: A Primer and an Application to HYV Rice Adoption. Agricultural Economics 27 (3): 383-402.

Hussain, N., A. Shahid, M. Naveed S. Muhammad (2014). An Estimation of Technical Efficiency of Garlic Production in Khyber Pakhtunkhwa Pakistan. International Journal of Food and Agricultural Economics 2 (2): 169-178.

Islam, K. M. Z., J. Sumelius and S. Bäckman (2012). Do differences in technical efficiency explain the adoption rate of HYV rice? Evidence from Bangladesh. Agricultural Economics Review 13(1): 93-110.

Javed, M. I., S.A. Adil, S. Hassan and A. Ali (2009). An Efficiency Analysis of Punjab’s Cotton-Wheat System. The Lahore Journal of Economics 14 (2): 97-124.

Krasachat, W (2003). Technical efficiencies of rice farms in Thailand: A nonparametric approach. Proc. Hawaii International Conference on Business 18-21 June 2003, Honolulu.

Khai, H. V., and M. Yabe (2011). Technical Efficiency Analysis of Rice Production in Vietnam. Journal ISSAAS 17 (1): 135-146

Latruffe, L., K. Balcombe, S. Davidova and S. Zawalinska (2002). Technical and Scale Efficiency of Crop and Livestock Farms in Poland: Does Specialization Matter? Working Paper Series No. 02-06, INRA.

Lissitsa, A., T. Coelli, and D.S.P Rao (2005). Agricultural Economics Education in Ukrainian Agricultural Universities: An Efficiency Analysis using Data Envelopment Analysis, Proceedings 11th International Congress of European Association of Agricultural Economists. August 24-27 2005, Copenhagen, Denmark.

Long, J.S (1997). Regression Models for Categorical and Limited Dependent Variables, SAGE Publications, London.

Ogunyinka, E.B and I.A. Ajibefun (2004). Determinants of Technical Inefficiency on Farm Production: Tobit Analysis Approach to the NDE Farmers in Ondo Stata, Nigeria. International Journal of Agriculture and Biology 6: 355-358.

Sudhagar, S. (2013). Production and Marketing of Cut flower (Rose and Gerbera) in Hosur Taluk. International Journal of Business and Management Invention 2 (5): 15-25.

Tobit, J. (1958). Estimation of Relationships for Limited Dependent Variables. Econometric 26: 24-36.

Usman, M. (2013). Marketing of Cut-Flowers: A case study of district Kasur. M.Sc (Hons.) thesis. Institute of Agricultural and Resource

Economics, University of Agriculture, Faisalabad.

Usman, M. and M. Ashfaq (2013). Economics analysis of tuberose production in Punjab, Pakistan. Sarhad Journal of Agriculture 29 (2): 279-284.

Usman, M., M. Ashfaq and I. Ali I (2013). Economic analysis of Statice cut-flower production in Punjab, Pakistan. Pakistan Journal of Agricultural Science 50(2): 311-315.

Usman, M., M. Ashfaq, S. Taj and M. Abid (2014). An Economic Analysis of Cut-Rose Flower in Punjab, Pakistan. The Journal of Animal and Plant Sciences 24(2): 651-655.

Usman, M., M. Ashfaq, A. Ali and A. Ghafoor (2014). Marketing of Cut-Flowers: A Case Study of District Kasur. ICDD Conference on Linkages, Value Chains and Development along the Rural-Urban Interface, University of Agriculture, Faisalabad Pakistan (January 9-12, 2014): P: 38.

Usman, M., M. Ashfaq, S.A.A. Naqvi, A. Ali, M.I. Javed, N. Nadeem, M.H. Raza and M. Waseem (2015a). An Efficiency Analysis of Gladiolus Cut-Flower in Punjab. Pakistan. Agric. Sci. 6: 663-669.

Usman, M., A. Ali, S. Hassan and M. Abid. (2015b). An Efficiency Analysis of Tuberose Cut-Flower: A Case Study. J. Anim. Plant Sci. 25(6): 1699-1706.