Asian Journal of Agricultural Extension, Economics & Sociology
5(2): 108-116, 2015; Article no.AJAEES.2015.044
ISSN: 2320-7027

SCIENCEDOMAIN *international*
www.sciencedomain.org

Economic Analysis of Outgrowers' Sugarcane and Paddy Production Scheme at Ruembe Sugarcane Basin in Kilosa District, Morogoro, Tanzania: A Comparative Approach

Joel Chongela[1*]

[1]Local Government Training Institute, P.O.BOX 1125, Dodoma, Tanzania.

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/AJAEES/2015/14190
Editor(s):
(1) Jamal Alrusheidat, Extension Education Department, National Centre for Agricultural Research and Extension (NCARE), Amman, Jordan.
Reviewers:
(1) Anonymous, Brazil.
(2) Anonymous, Germany.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=896&id=25&aid=8069

Short Research Article

Received 22nd September 2014
Accepted 23rd December 2014
Published 7th February 2015

ABSTRACT

An empirical study was undertaken to analyze economic resource constraints facing Ruembe outgrowers' sugarcane and paddy production scheme by measuring quantitatively scheme's productivity and profitability using Cobb-Douglas production function model and Gross margin.
The study adopted a quantitative study design. The empirical study was conducted at Ruembe Sugarcane Basin in Kilosa District in Morogoro Region Eastern part of Tanzania in 2007-2008 season. However, the multistage, purposive and systematic random sampling techniques were employed as sampling designs of the empirical study.
The empirical study found that fertilizer, labor, herbicides, land, credit and extension services are the main determinants of the sugarcane and paddy productivity as well as profitability in the study area. However, even though these farm inputs are the main determinants of crop productivity and profitability, still there is under utilization of it due to the fact that most of smallholder farmers are operating in the first region of the production function. Hence, according to the empirical findings, the study suggested that farmers should operate in the second region of production function in order

**Corresponding author: E-mail: chongela@yahoo.com;*

to utilize resources efficiently so that to maximize productivity and profitability of their farm produces. Moreover, according to the profitability of paddy enterprise found by the study, it is suggested that smallholder farmers could adopt warehouse receipt system model so as to protect them from price fluctuations which affect their profit.

Keywords: Economic analysis; Outgrowers' scheme; sugarcane and paddy productivity & profitability; Cobb-Douglas model; gross-margin.

1. INTRODUCTION

Sugarcane is an important commercial crop in Tanzania [1]. It is the main source of sugar produced for both export and domestic consumption. Currently, most of sugarcane is grown in estates owned by sugar processing factories as well as contract farmers [2]. In Tanzania sugarcane production is concentrated mainly in three regions: Morogoro, Kagera and Kilimanjaro [3]. The country currently has five sugar factories namely Illovo Sugar Company Limited (ISCL) having two factories (Kilombero I and II), Mtibwa Sugar Estate (MSE), Kagera Sugar Limited (KSL) and Tanganyika Planting Company (TPC) [4].

Sugarcane recorded a much higher growth in production from 2001 after several years of stagnation [5]. This significant growth can be attributed to the privatization of sugarcane estates based on Public-Private Partnership (PPP) policy and adoption of outgrowers' model of production which began early in 2000 [4].

At present sugar industry is the largest agro-processing industry in Tanzania [6]. In 2005/06 growing season the sugar industry produced a total of 263,000 tonnes of sugar and the amount was projected to increase to 467,000 tonnes by 2010 [7]. The sugar industry saves the country an equivalent of US$ 28 million annually in foreign exchange and contributes US$ 123 million annually to GDP, [7]. The sugar industry is also a major employer with a labor force of about 30,000 direct and over 80,000 indirect (secondary) employments [3].

Sugar supply is still inadequate in the country due to the fact that an average, annual sugar production is 300,000 tonnes against local demand of 500,000 tonnes. However, Tanzania imports about 200,000 tonnes per annum to offset the shortfall, [8].

Therefore, there are frequent sugar shortages during the year mainly because factories have to be closed momentarily for major repairs and also to await maturity of new season canes [1].

However, in remote villages, the commodity price is determined by local vendors; usually is higher than that at nearby town. Sugar therefore, is accessed only by a small proportional of the population, mainly town dwellers and salaried employees. Moreover, with increased prices, sugar supply appears not to meet the consumer demand because only a few people can purchase it. However, in an attempt to solve the problem of sugar supply in the country, the Tanzanian government has encouraged the small-scale producers to undertake sugarcane production through outgrowers' scheme model that allows households to produce the crop to feed the estate processing plants.

Although sugarcane outgrowers production schemes have been in existence for decades and several studies have been conducted in outgrowers sugarcane production schemes by using Cobb-Douglas production function such studies include: [9,10,11,12,13], the sugar supply is still inadequate in the country which is different from what is projected by the Tanzanian sugar policy.

The empirical study was carried out to analyze quantitatively productivity and profitability of sugarcane and paddy enterprises of outgrowers' scheme at Ruembe sugarcane basin in Morogoro region eastern part of Tanzania.

The paddy crop was selected for comparison with sugarcane because paddy is the second largest income generating crop of farm households after sugarcane in the study area. Although paddy is the second largest household income generating crop, it is also used as staple food in the study area. However, due to climate of 10^{o} Celsius in the highland and 30^{o} Celsius in the low land Ruembe sugarcane basin provides excellent sugarcane and paddy crops growing conditions in the flat, fertile areas at the base of Udzungwa Mountains in Tanzanian context.

2. METHODOLOGY

2.1 Data Sources and Sampling Designs

The primary data were collected through structured questionnaires contained both closed and open-ended questions focused to capture the production and marketing information of sugarcane and paddy crops from smallholder farmers. Sampling designs adopted by the empirical study were multistage, purposive and systematic sampling designs. Multistage technique was used to select divisions, wards, villages and households growing sugarcane and paddy crops in Kilosa district, Morogoro region in Tanzania. In the first stage 1 division was selected purposively, followed by 2 wards which were selected purposively in the second stage. In the third stage 3 villages were selected purposively from each ward. In the fourth stage 20 households of outgrowers from each village were selected by systematic sampling method. The whole sampling techniques resulted in having a sample size of 120 (1x2x3x20) households available for the empirical study.

2.2 The Cobb-Douglas Production Function Model

The Cobb-Douglas production functional model was employed in the study to analyze the technical relationship between productivity and resource constraints because it has been widely used by many researchers [14,15,16,17,18] as a suitable method to measure crop productivity of smallholder farmers. The ordinary least square (OLS) was employed to estimate the model. The productivities of sugarcane and paddy enterprises were compared to determine which enterprise use resource efficiently.

According to [19], the Cobb-Douglas model for sugarcane production enterprise can be expressed as:

$$Y = A * X_1^{a1} * X_2^{a2} * X_3^{a3} * X_4^{a4} * X_5^{a5} * D_1^{\lambda 1} * e^{\varepsilon i} \quad (1)$$

The equation 1 above was transformed into base 10 logarithmic linear functional form because the model is non-linear as shown below.

$$\text{Log}Y = A + a_1\log X_1 + a_2\log X_2 + a_3\log X_3 + a_4\log X_4 + a_5\log X_5 + \lambda_1 D_1 + \varepsilon_i \quad (2)$$

The Cobb-Douglas model for paddy production enterprise can be expressed as:

$$Y = A * X_1^{a1} * X_2^{a2} * X_3^{a3} * X_4^{a4} * D_1^{\lambda 1} * e^{\varepsilon i} \quad (3)$$

The log linear function of the equation 3 can be expressed as:

$$\text{Log}Y = A + a_1\log X_1 + a_2\log X_2 + a_3\log X_3 + a_4\log X_4 + \lambda_1 D_1 + \varepsilon_i \quad (4)$$

Where:

A = Intercept, a_1 …..a_n = coefficients of variables, λ_1 = dummy variable coefficients

Y = Productivity of sugarcane and paddy enterprises in tonnes/hectare, X_1 = Land under cane in hectares, X_2 = Labor in man-days/hectare, X_3 = Credit in US$/hectare

X_4 = Fertilizer in kilogram/hectare,

X_5 = Herbicide in litres/hectare

D_1 = Extension services dummy variable (D_1=1 if farmers are accessible to extension services and D_1 = 0 if farmers are not accessible to extension services). e^{ε} = error term.

2.3 The OLS Estimates

The OLS estimates ($\hat{a}_1, \hat{a}_2, \hat{a}_3, \hat{a}_4$) can be calculated as:

$$\hat{a}_1 = \delta \log Y / \delta \log X_1 = (\delta Y / \delta X_1)(X_1 / Y) \quad (5)$$

$$\hat{a}_2 = \delta \log Y / \delta \log X_2 = (\delta Y / \delta X_2)(X_2 / Y) \quad (6)$$

$$\hat{a}_3 = \delta \log Y / \delta \log X_3 = (\delta Y / \delta X_3)(X_3 / Y) \quad (7)$$

$$\hat{a}_4 = \delta \log Y / \delta \log X_4 = (\delta Y / \delta X_4)(X_4 / Y) \quad (8)$$

2.4 Gross Margins

Gross margins were employed to measure economic returns per unit of input used in sugarcane and paddy production enterprises because it is the most satisfactory measure of resource use efficiently available in small scale agriculture [20].

The gross margins of sugarcane and paddy enterprises were compared to determine which enterprise is more profitable than the other so as to advise farmers which crop they can produce subject to resource constraints.

Gross margin can be expressed as:

$$GM_i = TR_i - TVC_i \quad (9)$$

$$TR_i = \sum_{i=1}^{n} PyY \;,\quad TVC_i = \sum_{i=1}^{n} PxX \;,$$

$$GM_i = \sum_{i=1}^{n} PyY - \sum_{i=1}^{n} PxX \qquad (10)$$

Where:

GM_i = Gross margin of i^{th} farmer (US$/ha)
Px = Price of inputs (US$/unit)
TR_i = Total revenue of i^{th} farmer (US$/ha)
Y = Yield (tonnes/ha)
TVC_i = Total variable cost of i^{th} farmer (US$/ha)
X = Quantity of input (units/ha)
Py = Price of the crop (US$/ton)

3. RESULTS AND DISCUSSION

The 55% of proportion of variation in sugarcane productivity has been explained by the variation in land, labor, credit, fertilizer, herbicide and extension services jointly (Table 1). The R-square measures the proportion of variation in the dependent variable accounted for by explanatory variables.

The empirical result revealed that explanatory variables included in the model (land, labor, credit, fertilizer, herbicide and extension services) contribute statistically significant to sugarcane productivity because the F-value (25.27) is statistically significant at P = .0001 (Table 2).The implication of the result is that explanatory variables have significant contribution of 55% to sugarcane productivity. The rest (45%) of sugarcane productivity was contributed by other factors which were not studied by the econometric model developed by this empirical study.

3.1 Parameter Estimates

The negative sign of intercept (A) implies that when land, labor, credit, fertilizer, herbicide and extension services underutilized, sugarcane productivity is expected to decline by 42% (Table 3). The results implied that most of sugarcane outgrowers operate in the first region of production function whereby there is underutilization of resources.

The 15% of sugarcane productivity is explained by land (Table 3). When land under cane increases by one hectare the sugarcane productivity is expected to increase by 15% (0.15 tonnes per hectare). Land contributed less to sugarcane productivity because of underutilization of land in production process by smallholder farmers. This implies that sugarcane outgrowers are not operating in the production frontier to maximize yield, i.e., it is known as technical inefficiency.

The 33% of sugarcane productivity is explained by labor (Table 3). When labor increases by one man-days/hectare the sugarcane productivity is expected to increase by 33% (0.33 tonnes / hectare). This implies that labor contributed higher as compared to land because hired labor is highly used in production process of sugarcane.

The 11% of sugarcane productivity is explained by credit (Table 3). When credit increases by 100 US$ the sugarcane productivity is expected to increase by 11% (0.11 tonnes / hectare). This implies that credit contributes less as compared to land and labor because few smallholder farmers can access credit due to high interest rate of 12% based on short, medium and long terms credit from financial institutions such as National Microfinance Bank (NMB), Cooperative Rural Development Bank (CRDB) and Saving Account, Credit and Cooperative Societies (SACCOS).

The 47% of sugarcane productivity is explained by fertilizer application (Table 3). When fertilizer application increases by one tonne per hectare the sugarcane productivity is expected to increase by 47% (0.47 tonnes per hectare). Fertilizer contributed high as compared to other inputs because farmers were provided fertilizer subsidies. Even though farmers were provided fertilizer subsidies still there is under use of recommended rate of fertilizer application due to inadequate of fertilizers from fertilizer companies contracted by the Tanzanian government to sell fertilizers to farmers on 50% price per bag of 50 kg because 50% price is paid by the Tanzanian government.

The 17% of sugarcane productivity is explained by herbicide application (Table 3). When herbicide application increases by 10 litres per hectare the sugarcane productivity is expected to increase by 17% (0.17 tonnes per hectare). Herbicide seems to contribute less to sugarcane productivity because farmers underutilize the recommend rate of herbicide application because herbicide is expensive therefore they cannot afford to purchase a large amount of herbicides.

When the number of cane growers accessing extension services increases by one percent the

sugarcane productivity is expected to increase by 10% (0.10 tonnes per hectare) (Table 3). The low sugarcane productivity is attributed by the lack of extension services due to shortages in the number of extension personnel in the study area.

3.2 Paddy Production Enterprise

The 82% of proportion of variation in paddy productivity has been explained by the variation in land, labor, fertilizer, herbicide and extension services jointly (Table 4). The R-square measures the proportion of variation in the dependent variable accounted for by explanatory variables. The remaining eighteen percent (18%) is explained by other factors which were not included in the econometric model. The credit as an independent variable was dropped from the econometric model due to the fact that paddy enterprise was not determined as collateral to access credit from financial institutions because it is a seasonal crop.

The empirical results show that explanatory variables included in the econometric model (land, labor, fertilizer, herbicide and extension services) contribute statistically significant to paddy productivity because the F-value (110.341) is statistically significant at P = .0001 (Table 5).

3.2.1 Parameter estimates

The negative sign of intercept (A) implies that when land, labor, fertilizer, herbicide and extension services utilized at minimum level, paddy productivity is expected to decline by 23% (Table 6). The empirical results imply that most of sugarcane outgrowers' operate in the first region of production function whereby there is underutilization of resources. The 43% of paddy productivity is explained by land (Table 6). If land under paddy production increases by one hectare the paddy productivity is expected to increase by 43% (0.43 tonnes per hectare). This implies that land had high contribution to paddy productivity as compared to sugarcane productivity where land had contribution of 15% because subsistence farmers are much more conscious with food crop to avoid hunger occurrence. However, in both enterprises farmers were operating in the first region of production function where there is underutilization of resources.

The 10% of paddy productivity is explained by labor (Table 6). When labor increases by one man-day per hectare the paddy productivity is expected to increase by 10% (0.10 tonnes per hectare). The results implied that labor contributed less to paddy productivity as compared to sugarcane productivity where by labor contributed by 33% because mostly family labor is used in paddy production in contrast to hired labor which is mostly used in sugarcane production.

The 29% of paddy productivity is explained by fertilizer application (Table 6). When fertilizer application increases by one tonne per hectare the paddy productivity is expected to increase by 29% (0.29 tonnes per hectare). The results implied that fertilizer contributed less to paddy productivity as compared to sugarcane productivity which contributed 47% due to the fact that farmers were applied under recommended rate of fertilizer due to absence of fertilizer subsidies for paddy production. However, in both crop enterprises there was a failure to operate in the production frontier due to inefficient use of resources in the first region of production function which leads to minimum crop yields.

The 9% of paddy productivity is explained by herbicide application (Table 6). When herbicide application increases by 10 litres per hectare the paddy productivity is expected to increase by 9%

Table 1. Model summary

R-Square	Adjusted R-square	Standard error	Observation
0.57	0.55	0.057	120

Table 2. Analysis of variance

Source	DF	SS	MS	F-value	P-value
Regression	6	0.51	0.084	25.27	.0001
Error	113	0.37	0.003		
Total	119	0.88			

Table 3. Parameter estimates

Variables	Parameters	Coefficients	Std error	t-stat	P-value
Intercept	A	-0. 42	0.25	-1. 72	.09
Land	a_1	0. 15	0.03	0. 57	.57
Labor	a_2	0. 33	0.05	6.27**	.0001
Credit	a_3	0. 11	0.08	1.49	.14
Fertilizer	a_4	0. 47	0.09	4.75**	.0001
Herbicide	a_5	0. 17	0.04	4.30**	.0001
$ExtD_1$	λ_1	0. 10	0.01	0.86	0.39

*Note **t-values are significant at P = .0001 implies that they are statistically significant at 5% level of significance.*

Table 4. Model summary

R-Square	Adjusted R-square	Standard error	Observation
0.83	0.82	0.079	120

Table 5. Analysis of variance

Source	DF	SS	MS	F-value	Sign F-value
Regression	5	3.478	0.695	110.341	.0001
Error	114	0.719	0.006		
Total	119	4.197			

(0.09 tonnes per hectare). The results implied that herbicide contributed less to paddy productivity as compared to sugarcane productivity where by herbicide contributed by 17% because smallholder farmers were applied under recommended rate of herbicides due to high cost of herbicides.

If the number of paddy growers accessing extension services increases by one percent (1%) the paddy productivity is expected to increase by 15% (0.15 tonnes per hectare) (Table 6). On the other hand if the number of cane growers accessing extension services increases by one percent (1%) sugarcane productivity is expected to increase by 10%. The low paddy and sugarcane productivities were attributed by the lack of extension services due to shortages in the number of extension personnel in the study area.

The empirical results discussed above show that, there was resource use inefficiency for both crop enterprises because farmers were operating in the first region of production function; hence fail to reach their maximum yields.

3.3 Gross Margins Analyses of Sugarcane and Paddy Production Enterprises

Gross margin of farm activity is the difference between gross income earned and the variable cost incurred [21]. The results of gross margins analyses of sugarcane and paddy enterprises are indicated in Table 7. The analyses involve variable costs of ploughing, harrowing, furrowing, planting, weeding, herbicide application, fertilizer application and harvesting. Harvesting includes: cane cutting, cane loading, cane haulage and transportation of sugarcane from the field to the factory. Other costs are purchase of seed canes, paddy seeds, fertilizers, herbicides and milling of paddy. The milling of sugarcane is excluded from calculation of variable costs because it is taken care by the sugar factory. Furrowing is not applied to paddy producers because paddy production is a flooding agriculture.

The results revealed that sugarcane production is a profitable enterprise because it earned a positive gross margin of 565 US$/hectare (Table 7) followed by paddy enterprise which earned a magnitude gross margin of 73 US$/hectare (Table 7). Paddy enterprise earned less profit due to minimum price offered to crop producers influenced by high supply of paddy in the study area. Hence, economic stimulus packages like minimum support price are highly recommended to be given to farmers as a support to them from price fluctuation attributed to high supply leading into floating of the market.

The calculation of total variable cost, total revenue and gross margins were performed based on the formulas given in equations 9 and

Table 6. Parameter estimates

Variables	Parameters	Coefficients	Std error	t-stat	P-value
Intercept	A	-0.23	0. 13	-1.71	.0907
Land	a_1	0.43	0. 07	6.27**	.0001
Labor	a_2	0.10	0. 06	1.68	.0966
Fertilizer	a_3	0.29	0. 08	3.74**	.0001
Herbicide	a_4	0.09	0. 05	1.56	.1215
$ExtD_1$	λ_1	0.15	0. 02	6.90**	.0001

*Note **t-values are statistically significant at P = .0001, implies that they are significant at 5% level of significance*

Table 7. Ruembe Sugarcane outgrowers: Gross margins analyses for sugarcane and paddy production enterprises (2007/2008)

variable cost item	variable cost of sugarcane production enterprise (US$/ha)	variable cost of paddy production enterprise (US$/ha)
Ploughing	90	80
Harrowing	70	70
Furrowing	65	-
Planting	60	65
Weeding	150	120
Herbicide application	30	20
Fertilizer application	30	30
Harvesting	300	100
Transports	200	200
Seed canes/paddy seeds	500	60
Fertilizers	700	500
Herbicides	400	300
Milling	-	500
Total Variable Cost (TVC)	2,595	2,045
Total Revenue (TR)	3,160	2,118
Gross Margin (GM)	565	73

Exchange rate in 2008: 1 US$ = 1,200 TZS

10 above. After running data analysis using excel package, the total variable cost and total revenue of 120 household farmers were obtained. The gross margin was obtained by reducing total variable cost from total revenue as shown below.

3.3.1 Sugarcane production enterprise

Gross Margin = 3,160 US$/ha – 2,595 US$/ha = 565 US$/ha

3.3.2 Paddy production enterprise

Gross Margin = 2,118 US$/ha – 2,045 US$/ha = 73 US$/ha

4. CONCLUSION AND POLICY IMPLICATIONS

The sugarcane and paddy productivities were influenced by resource constraints namely: land, labor, credit, fertilizers, herbicides and extension services. According to the empirical findings of the study farmers were expected to maximize their yield as well as profit subject to resource constraints. However, due to underutilization of resources in first region of production function most of smallholder farmers were failed to reach the maximum yield as well as profit of their enterprises which implies that there were technical and allocative inefficiencies of resources in the production process for both crop enterprises. Therefore, smallholder farmers were advised to utilize resources at maximal level so that they would operate in the second region of production function to maximize their yield and profit.

According to findings of the study, gross margin analyses showed that sugarcane production enterprise was much more profitable as compared to paddy enterprise because of contract farming between the sugarcane outgrowers' and the Illovo Sugar Company which

used to buy sugarcane at reasonable price as per contract signed between the two parts. On the other hand paddy production enterprise earns less profit due to excess supply of paddy in the marketplace resulted from surplus production of the commodity which leads to shrink in consumer price. Hence, the study suggested that warehouse receipt system model could be adopted by paddy producers so that to protect them from fetching low prices of their farm produces. However, the adoption of warehouse receipt system model can motivate arbitragers and hedgers to buy and sell the crop at reasonable price, this can benefit paddy smallholder farmers. Also minimum support price can be given to farmers as a stimulus package to motivate farmers to produce the crop, this has been done in many developing world like India and Ethiopia.

The low crop productivity is attributed by the lack of extension services due to shortages in the number of extension personnel in the study area. Hence, the Tanzanian government should restructure the agricultural extension policy and come up with a policy of training more extension service providers and supply them to remote areas to advise farmers on enhanced agronomical practices of crop production.

Smallholder farmers were applied below the recommended rate of herbicides due to high price of herbicides. Tanzanian government therefore, should reform the agricultural inputs policy so that to accommodate provision of herbicide subsidies to sugarcane and paddy growers so as to enable smallholder farmers to control pests and diseases which impede crop productivity and profitability.

ACKNOWLEDGEMENTS

Valuable comments from anonymous reviewers of this manuscript were highly appreciated by the author.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Tarimo JP, Takamura YT. Sugarcane Production, Processing and Marketing in Tanzania. Joint paper prepared for the Department of Crop Science and Production. Sokoine University of Agricultural. Morogoro Tanzania and Center for African Area Studies, Kyoto University, Japan; 2001.
2. United Nations Committee of Trade and Development (UNCTAD). Expert Meeting on Enabling Small Commodity Producers in Developing Countries to Reach Global Market; 2006.
Available:http://www.unctad.org/commodities/html
3. BACAS (Bureau of Agriculture Consultancy and Advisory Services). Institutional Mapping of Sugar Draft Report on Phase II. Sokoine Agricultural University. Morogoro, Tanzania. 2004;72.
4. Ashimogo GC, Msuya EE. An Estimation of Technical Efficiency in Tanzania sugarcane production: A case study of Mtibwa Sugar Company outgrowers scheme. Journal of Agricultural Economics. 2006;4:137-150.
5. United Republic of Tanzania (URT) 2002 Census Report; 2003.
Available: http//www.tanzania.go.tz
6. Shaban RS, Heary RK. Impact of European Union Sugar Trade on Developing Countries. Germanwatch, German. 2003;8-43.
7. Tanzania Sugarcane Growers Association. Social and Institutional Feasibility of Block Farming of Kilombero Sugar Company Outgrowers. Dar es salaam Tanzania. 2007;33.
8. Food and Agricultural Organization; Sugar Annual Report; 2007.
Available: http://www.fao.org
9. Senkondo EM. Economic Analysis of Sugar Industry in Tanzania: A case of Kilombero Sugar Company. Dissertation for award of Msc. degree at Sokoine Agricultural University. Morogoro, Tanzania. 1998;30-60.
10. Damas P. Economic Analysis of Medium Scale Agricultural Enterprises in a predominantly smallholder agriculture sector. Dissertation for award of Msc. Degree at Sokoine Agricultural University. Morogoro. Tanzania. 2001;10-47.
11. Msuya EE. An Estimation of Technical Efficiency in Tanzania Sugarcane Production: A case study of Mtibwa Sugar Estate Outgrowers Scheme. Dissertation for award of Msc. degree at Sokoine Agricultural University. Morogoro, Tanzania. 2003;20-48.

12. Machangu JS. Economic Impact of Project Intervention in Sugarcane and Cotton Outgrowers. Dissertation for award of Msc. degree at Sokoine Agricultural University. Morogoro, Tanzania. 2005;37-64.
13. Reginard I. Contribution of Outgrowers Scheme in the Household Poverty Reduction. Dissertation for award of Msc. degree at Sokoine Agricultural University. Morogoro, Tanzania. 2006;45-77.
14. Kiresur VR, Melinamani VP, Kulkararni VS, Pushpa Bharati, Yadav, VS. Agricultural Productivity Rural Poverty and Nutritional Security: A Micro Evidence of Inter-Linkage from Karnataka State India: Journal of Agricultural Economics Research Review. 2010;23(1):29-40.
15. Rama IVY. Economic Analysis of value addition in sugarcane in North Coastal zone of Andhra Pradesh: India Journal of Agricultural Marketing. 2010;24(2):41-49.
16. Seyoum ET, Battese GE, Fleming EM. Technical efficiency and productivity of maize producers in eastern Ethiopia: A study of farmers within and outside Sasakawa-Global 2000 project. Agricultural Economics Journal. 2004;19: 341-348.
17. Beringer C. Estimating enterprise production functions from input-output data on multiple enterprise farms. Journal of Farm Economics. 2003;38:923-930.
18. Bravo-Ureta BE, Evenson RE. Efficiency in Agricultural Production: The case of peasant farmers in Eastern Paraguay. Agricultural Economics Journal. 1994;10: 23-37.
19. Gujarati ND, Sangeetha. Basic Econometrics, 4th edition. Tata McGraw Hill Education Private Limited, New Delhi, India. 2007;834.
20. Phiri CD. An Evolution of Smallholders Farming Systems in Chinguluwe Settlement Scheme in Malawi. Issue in African Rural Social Networks; 1991.
21. Abbot JC, Makeham JP. Agricultural Economics and Marketing in the Tropics. Longman Group Limited, Harlow. England. 1990;194.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=896&id=25&aid=8069