
BENEFIT-COST ANALYSIS OF DRY SEASON VEGETABLE PRODUCTION IN URBAN AND PERI-URBAN TAMALE

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ABSTRACT

This study analysed the benefit-cost ratio of dry season vegetable production in urban and peri-urban Tamale. It provides some information on the profitability of vegetable production so as to encourage more people to go into it. It also identified production constraints. The study covered 30 vegetable farmers, 15 from urban and 15 from peri-urban Tamale. Cabbage, okra and corchorus farmers were randomly sampled. The analytical tools used are benefit-cost ratio and Kendall's Coefficient of Concordance. Peri-urban vegetable production was found to be more cost-effective and economically viable though urban dry season vegetable production had a higher monetary value. This is because whilst peri-urban vegetable production gave a benefit-cost ratio of 3.03, urban vegetable production gave a ratio of 2.57. On individual crop basis, peri-urban cabbage production was found to be the most profitable with a benefit-cost ratio of 4.31. Major constraints to vegetable production were identified as high cost of fertilizer, variable prices of output, high labour cost, pests and diseases, high cost and poor quality of seed. It is strongly recommended, among others, that micro credit institutions should come to the aid of vegetable producers in urban and peri-urban Tamale, since they are highly capable of repayment.

INTRODUCTION

Industrialization and other economic activities have contributed significantly to the increase in number of urban centres. A modest proportion of the population now lives in the urban areas as a result of large scale migration from the rural areas (Hossain, 1996). Acute rural poverty, lack of employment opportunity, loss of soil fertility, unequal distribution of national resources among rural and urban areas are some of the factors serving as a driving force for the rural-urban exodus. The annual population growth rate, which is estimated as high as 2.6 percent in Ghana (GSS, 2002), is also a contributory factor. The result is an increasing demand of urban people for various food supplies including vegetables. Vegetables are good sources of vitamins and minerals (Craig and Beck, 1999) and their scarcity impacts negatively on the urban population,

especially the poor segment since they cannot afford the expensive sources of vitamins and minerals. Vegetable production therefore has to be stepped up to keep pace with the ever increasing urban population.

There is no major stream passing through Tamale nor its environs and the groundwater table is low as a result vegetable production is carried out by a few farmers in the dry season around dams and dugouts constructed mainly for watering animals in the communities and along wastewater drains (Obuobie et al, 2006). There is also wet season production of vegetables such as garden eggs, local leafy vegetables, tomato and pepper.

Organic as well as inorganic fertilisers are used in the cultivation using the same piece of land continually. Though production is on small scale it is a good source of income to the farmers and traders

who deal in these vegetables. According to Clotey et al (2006) dry season production is more profitable than that of the rainy season.

A basic assumption about farming as a business is that farmers want to maximize profit, besides achieving other goals like stable income and food security. Thus, for prospective urban and/or peri-urban vegetable farmers, their objective is clear, to make money from vegetable production. Tamale, like any other city, is plagued with vegetable shortages as the population of the city keeps increasing. There is the need to intensify both urban and peri-urban vegetable production to meet this rising demand. Knowledge of the profitability of vegetable production would attract some people into it. Against this background, this study conducted a benefit-cost and constraints analyses of dry season vegetable production in urban and peri-urban Tamale. The study is useful as it unearthed the benefits of urban and peri-urban vegetable production (specifically cabbage, okra and corchorus), thereby informing planning for poverty reduction. Information provided by the study is also required for urban agriculture development.

METHODOLOGY

Data Collection

Principally, the study uses a cross sectional data set. The data was collected from vegetable farmers between March and May, 2002 which coincided with the harvesting of dry season vegetables. A structured questionnaire - covering the socio-demographic characteristics of the farmers' households, labour use in production, marketing activities and constraints in production was used. Thirty (30) vegetable farmers, consisting of 15 from urban Tamale: Gumbihini and Kalponhini/Sagani, and 15 from peri-urban Tamale: Bontanga and Libga, were sampled. Both purposive and simple random sampling procedures were used in the selection of communities and farmers. Crops were harvested at regular intervals and the yields were weighed at each harvest.

Data Analysis

The study employs the benefit-cost ratio and the Kendall's Coefficient of Concordance to achieve the objectives of analyzing the benefit-cost and constraints respectively of dry season vegetable production.

Benefit-cost Analysis

A benefit-cost analysis was conducted in order to determine the profitability of urban and peri-urban vegetable production for comparison. The costs incurred and incomes obtained were calculated for individual producers in order to arrive at average benefit-cost ratio per crop in urban and peri-urban Tamale. According to Gittinger (1982), benefit-cost ratio is given by:

$$B/C \text{ ratio} = \frac{\sum_{t=1}^n \frac{B_t}{(1+r)^t}}{\sum_{t=1}^n \frac{C_t}{(1+r)^t}} \quad (1)$$

where B_t is benefits in each year, C_t is costs in each year, n is number of years and $t = 1, 2, 3, \dots, n$,

But the study gathered cross-sectional data on a single dry season implying that $n = 1$ and thus B_t and C_t components could not be discounted. The formula then reduces to:

$$B/C \text{ ratio} = \frac{B_t}{C_t} \quad (2)$$

This reduced form of the formula has been validated by the fact that Panel (1970) indicated that discounting may or may not be attempted in calculating benefit-cost ratios. An average benefit-cost ratio of one or more for the production of any vegetable crop means that crop is worth producing. To ensure a fair basis for comparison, all calculations were done on per hectare basis.

Constraints Analysis

The study uses the Kendall's Coefficient of Concordance (W) in the identification of production constraints. The Kendall's Coefficient of

Concordance (W) is the measure of the degree of agreement/concordance among m sets of n ranks. It is an index that measures the ratio of the observed variance of the sum of ranks to the maximum possible variance of sum of ranks. The essence of this index is to find the sum of the ranks for each thing being ranked and to examine the variability of this sum. If the rankings are in perfect agreement the variability among these sums is said to be a maximum (Mattson, 1986).

The analysis is a statistical technique that is used to identify and rank a given set of constraints into the most pressing one up to the least pressing one and then measures the degree of agreement between these constraints. Usually, the identified constraints are ranked according to the most pressing to the least pressing using numerals such as 1,2,3,...,n, in that order. The constraint with least total score is ranked as the most pressing whilst the one with the highest score is ranked as the least pressing. The computed total rank score is then used to calculate the W.

The value of W is positive in sign and ranges from 0 to 1. It is 1 when the values assigned by one judge (producer) are exactly the same as those assigned by other judges (producers), and is 0 when there is maximum disagreement among the judges.

Given T represents the sum of ranks of each production constraint being ranked the variance of the sum of ranks is given by:

$$Var_T = \frac{\sum T^2 - (\sum T)^2 / n}{n} \quad (3)$$

The maximum variance of T is then given by:

$$m^2(n^2 - 1) / 12 \quad (4)$$

where m = the number of sets of rankings (producers), and n = the number of things being ranked (production constraints).

The formula for the Coefficient of Concordance (W) is thus given as:

$$W = \frac{[\sum T^2 - (\sum T)^2 / n] / n}{m^2(n^2 - 1) / 12} \quad (5)$$

Equation (3) further simplifies to the computational formula as:

$$W = \frac{12[\sum T^2 - (\sum T)^2 / n]}{nm^2(n^2 - 1)} \quad (6)$$

The null and alternative hypotheses are stated as follows:

Ho: There is no agreement among the rankings of vegetable production constraints in urban and peri-urban Tamale, versus

HA: There is agreement among the rankings of vegetable production constraints in urban and peri-urban Tamale.

The Coefficient of Concordance (W) may be tested for significance in terms of the F distribution. It is given by:

$$F = \frac{[(m-1)W_c]}{(1-W_c)} \quad (7)$$

where W_c is the calculated Coefficient of Concordance (W).

The F-statistic has $(n-1) - 2 / m$ degrees of freedom for the numerator, and

$(m-1)[(n-1) - 2 / m]$ degrees of freedom for the denominator.

(7)

RESULTS AND DISCUSSION

Benefit and Cost of Vegetable Production

Yields, benefits and costs were computed for each farmer to arrive at the average figures presented in Table 1. Average yields per hectare of vegetables produced in urban Tamale are comparatively higher than those in peri-urban Tamale, except in the case of peri-urban cabbage production. The lower prices in the peri-urban areas are due to distance hence, transport cost to the main market in Tamale and traders taking advantage of the farmers. From Table 1, peri-urban cabbage production has a higher average yield (11.52 tonnes) than urban cabbage production (8.30 tonnes). It is the highest among urban and peri-urban vegetable production studied. This is because there was enough water in the peri-urban areas throughout the growing season hence the farmers watered the crops well and the soils used had more organic matter. With okra and corchorus,

Table 1: Benefit-cost ratio of crops

<i>Crop</i>	<i>Average Yield (t/ha)</i>	<i>Average Cost</i>	<i>Average Revenue (GH¢/ha)</i>	<i>Average Profit (fGH/ha)</i>	<i>Average B/C ratio (GH¢)</i>
Cabbage (urban)	8.30	606.76	1,617.80	1,011.04	2.67
Cabbage (peri-urban)	11.52	383.24	1,650.00	1,266.76	4.31
Okra (urban)	5.13	620.00	1,377.50	757.50	2.22
Okra (peri-urban)	2.21	213.50	415.00	201.50	1.94
Corchorus (urban)	4.46	529.20	1,518.00	988.80	2.87
Corchorus (peri-urban)	1.44	257.30	525.00	267.70	2.04

Source: Survey Data, 2002

urban production has higher yields than peri-urban production. This is due to high demand which made farmers have shorter harvesting intervals since the farms were near the homes.

Average returns are highest for peri-urban cabbage production than all the other crops also as found by Gyiele (2002) of cabbage among other vegetables in Kumasi. This is due to the higher average yield per hectare. The average profitability value of GH¢757.50 for urban okra production is more than that of peri-urban okra production (GH¢201.50). Also, profitability for urban corchorus production is higher than peri-urban corchorus production as shown in Table 1. This is because there is high demand for the vegetables in urban Tamale than supply and the farmers sell on the farm mainly to consumers while the peri-urban farmers sell to traders from the urban area who transport them to sell. The low cost of production in all cases in the peri-urban areas is due to better soil fertility, low expenditure on fertiliser and lower cost of labour. In the urban areas the same piece of land is used for many years and continuously.

Peri-urban cabbage production has the highest average benefit-cost ratio of 4.31 and thus emerges as the most profitable with the profitability value of GH¢1,266.76. The benefit-cost ratio of 4.31 means

that total cost forms only one-quarter of total revenue. The least profitable is peri-urban okra production (GH¢201.50) with a benefit-cost ratio of 1.91.

Comparing the overall profitability of urban and peri-urban vegetable production, grand averages were calculated. From Table 2, though urban vegetable production gives a higher monetary value of GH¢919.11 as profit, its benefit-cost ratio of 2.57 is lower than that of peri-urban vegetable production which is 3.03. The implication is that peri-urban vegetable production is more cost effective and hence viable than urban vegetable production. Thus, peri-urban dry season vegetable production is economically more profitable since it has a higher benefit-cost ratio.

Vegetable Production Constraints

Table 3 presents ranked constraints to vegetable production in the study area and also as analysed using the Kendall's Concordance Coefficient. High fertiliser cost turned out to be the most pressing constraint in both urban and peri-urban vegetable production. This is also reported by Obeng-Ofori et al (2007) under the general constraints of vegetable production. It was observed that farmers mostly applied fertilisers to cabbage and okra and in some instances to corchorus. However, fertiliser prices kept rising almost every season, which farmers

Table 2: Overall profitability rating of urban and peri-urban vegetable production

Type of production	Grand average cost (GH¢/ha)	Grand average revenue (GH¢/ha)	Grand average profit (GH¢)	Grand B/C ratio
Urban production	585.32	1,504.43	919.11	2.57
Peri-urban production	284.68	963.33	578.65	3.03

Source: Survey Data, 2002

Table 3: Urban and peri-urban vegetable production constraints

Constraint	Sum of rank (T)	Squared sum of rank (T ²)	Remark / rank
Variable output price	62	3844	2
Pests and diseases	127	16129	4
High fertiliser cost	60	3600	1
Poor quality seed	169	28561	7
High labour cost	75	5625	3
High seed cost	160	25600	6
Others	151	22801	5
Total	804	106160	

$$W_c = 0.55 \quad F_{cal} = 35.19 \quad F_{crit(6, 171, 0.001)} = 2.80$$

Source: Survey Data, 2002

describe as outrageous. This situation was compounded by the removal of subsidy on inputs for some category of farmers.

Variable prices of their produce emerged as the second most pressing constraint of vegetable producing. Normally, there is a glut at harvest time and that compels producers to sell their produce at ridiculously low prices to traders since they are unable to store the rather highly perishable vegetables like cabbage and corchorus. Prices are however high during periods of scarcity. The seasonal nature of the vegetables thus accounted for the variability in prices as also stated by Adegeye and Dittoh (1985).

Production of vegetables, especially the exotic ones like cabbage, is labour intensive. Vegetables require intensive care from seed germination to crop maturity. It is thus a common practice for both urban and peri-urban vegetable producers to engage the services of hired farm labour. Producers considered the cost of engaging labour as high.

Pests and diseases are considered the next most pressing constraint as farmers could not afford pesticides. Pests and diseases are important yield reducers, especially in exotic vegetable production hence farmers sprayed with all kinds of chemicals. Constraints classified under others include inadequate water and lack of credit are next followed

by poor quality seed and high seed cost.

From the analysis, there was 55.0 percent agreement among the rankings farmers assigned to the various constraints and this is significant at the 1.0 percent level since the F_{cal} is greater than the F_{crit} . Therefore the null hypothesis that there is no agreement among the rankings of vegetable production constraints in urban and peri-urban Tamale is rejected.

CONCLUSION

The paper has contributed in unearthing the profitability of urban and peri-urban vegetable production. The results showed that vegetable production under irrigation is profitable. It further revealed that peri-urban vegetable production is more cost-effective and viable. The implication is that if resources such as credit, technical advice and government support are invested in peri-urban vegetable production, it will serve as an important source of lucrative employment for the jobless in the peri-urban areas.

The results have implications for boosting urban and peri-urban vegetable production. First, there is the need for a micro credit scheme with an attractive and affordable interest rate exclusively to cater for vegetable production in urban and peri-urban Tamale. This will enable farmers to acquire needed inputs, the costs of which they consider high, for increased production. Second, organic farming should also be vigorously promoted among farmers to cut down on expenditure on inputs.

Again, efforts should be made by extension staff of Ministry of Food and Agriculture to educate farmers on the dangers of using banned chemicals such as dichlorodiphenyltrichloroethane (*DDT*) for spraying and also to keep them abreast with emerging innovations.

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